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assembly & fastener ENGINEERING

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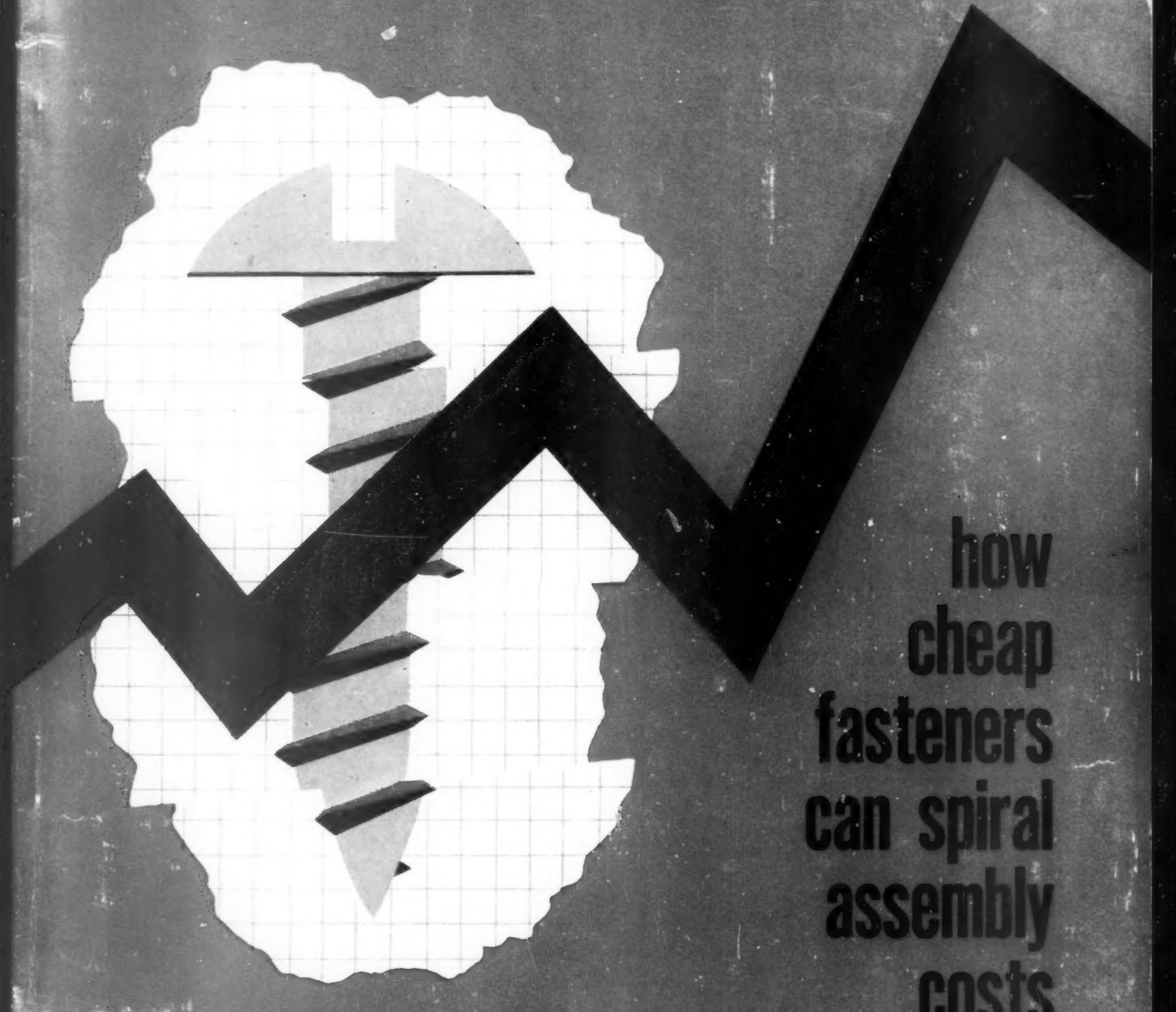
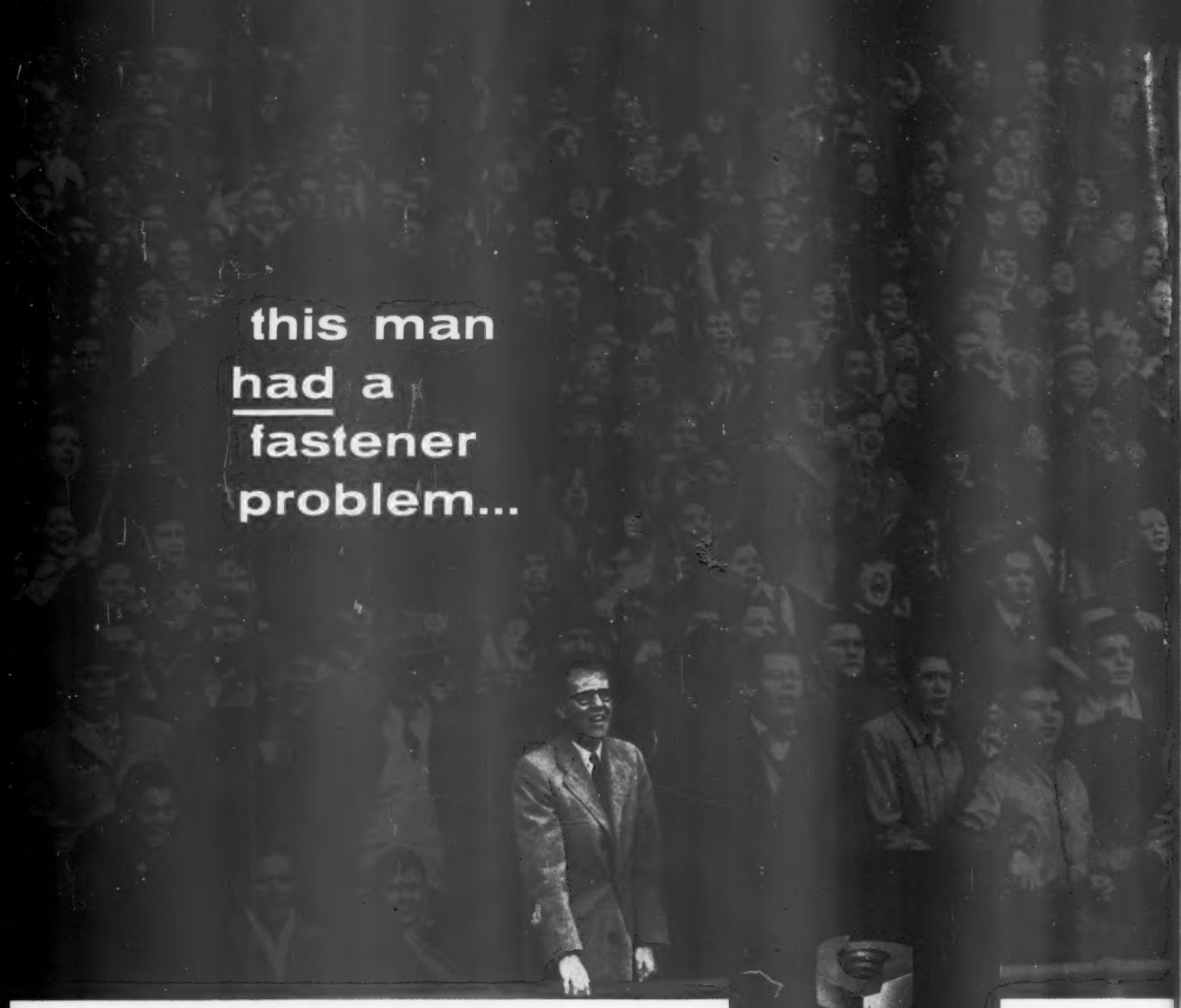


how cheap fasteners can spiral assembly costs

Also in this Issue: FRICTION AS A FACTOR IN BOLT TENSION • ELECTRON BEAM WELDING HARD-TO-JOIN METALS



and here's how Pheoll solved it

He's just a voice in the grandstand now — but as an official of a shoe company he himself recently quarterbacked a major victory. Faced with a fastener problem he called the signals that brought in the Pheoll team.

Briefly, the problem was one of redesigning a nut used in holding a stud to a football shoe cleat. In its original "straight notch" design, the stud often worked loose under game conditions.

In producing football cleats, screws are built into the bottom sole of the shoe. These screws have flat washers which "cut" into the sole to keep them from turning. Here, a special "One Way Hex Nut"— developed and produced by Pheoll — is tapered and notched at the same angle, but in opposite direction to the notches in the washer. The nut rides in over the top of the washer and as it is turned down, it tightens and binds — forming a positive lock that can't ride or work loose.

Designing, Engineering, Production. At Pheoll it's all wrapped up in one word: Service . . . the effort and ability to serve you expediently and efficiently.

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Enlargement of One Way Nut

PHEOLL P

HEADING THE FASTENER INDUSTRY FOR OVER 50 YEARS

assembly & fastener ENGINEERING

Better Design and Engineering for Assembly

January, 1961 Volume 4, Number 1

FEATURES

How Cheap Fasteners Can Spiral Assembly Costs 27

The experience of one company proves it's not the initial cost of fasteners that counts, but rather their in-place cost in the final assembly.

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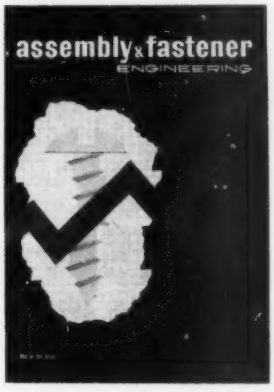
• Cheap fasteners can be anything but bargains. If you don't believe it, just read our cover story which starts on page 27.



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EPA

New all-wrench tool set cuts maintenance time

Snap-on

181-piece nut-turning set

SNAP-ON 5181-GS-B Set
181 tools in metal box

This SNAP-ON set is the timesaving answer for a maintenance man with a wide range of nut-turning jobs. The selection of 181 tools contains every standard wrench size from 3/16 to 1-7/8 in. Included are open-end wrenches, box wrenches, combination wrenches, flexible head wrenches, ratcheting box wrenches and socket wrenches.

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Tool chest embodies all the best SNAP-ON construction features — full-length, piano-type hinges; reinforced channel top; easy-sliding, no-sag drawers; close spot welding for added strength; double-rolled edges for rigidity; and strong trunk handles for lifting the chest.

Got a tool problem — ask your SNAP-ON sales engineer

The SNAP-ON sales engineer is a specialist who devotes *all of his time* to the industrial application of wrenches and mechanics' hand tools. He welcomes the opportunity to help you solve your assembly and maintenance tool problems. Write us for his name or call your nearest branch. Free catalog of industrial wrenches is yours for the asking.

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Letters to the Editor

Christmas Editorial

Regarding your Christmas editorial, "Prove all things, hold fast that which is good", this is a spirtually endowed command. Your editorial forcefully brings it out.

I share your point of view and am grateful to you for bringing out such powerful truths through the means of your good magazine. The time is more than appropriate for such fearless and nonsectarian views of God, free from doctrine but available to all mankind.

Peter Kneisel
Ripon, Wisconsin

In the verse which you quote, the sense of the word "prove" is "test" . . . . Seeing this biblical quotation on the cover of a technical magazine, prompted this motto for development engineers: "Test all things; retain those which are good, i.e., pass the test".

John E. Ellison
Manchester, Connecticut

Audio-Visual Systems

I wish to congratulate you on the cover illustration for your November feature on audio-visual assembly systems. You are one of the few publishers to show 35mm movie film in the correct proportions, i.e., exactly with four sprocket holes per frame, rounded frame edges, etc.

Clyde Gouldsberry
Machine & Tool Designer
American Chain & Cable Co.
Auto and Aircraft Division
Adrian, Michigan

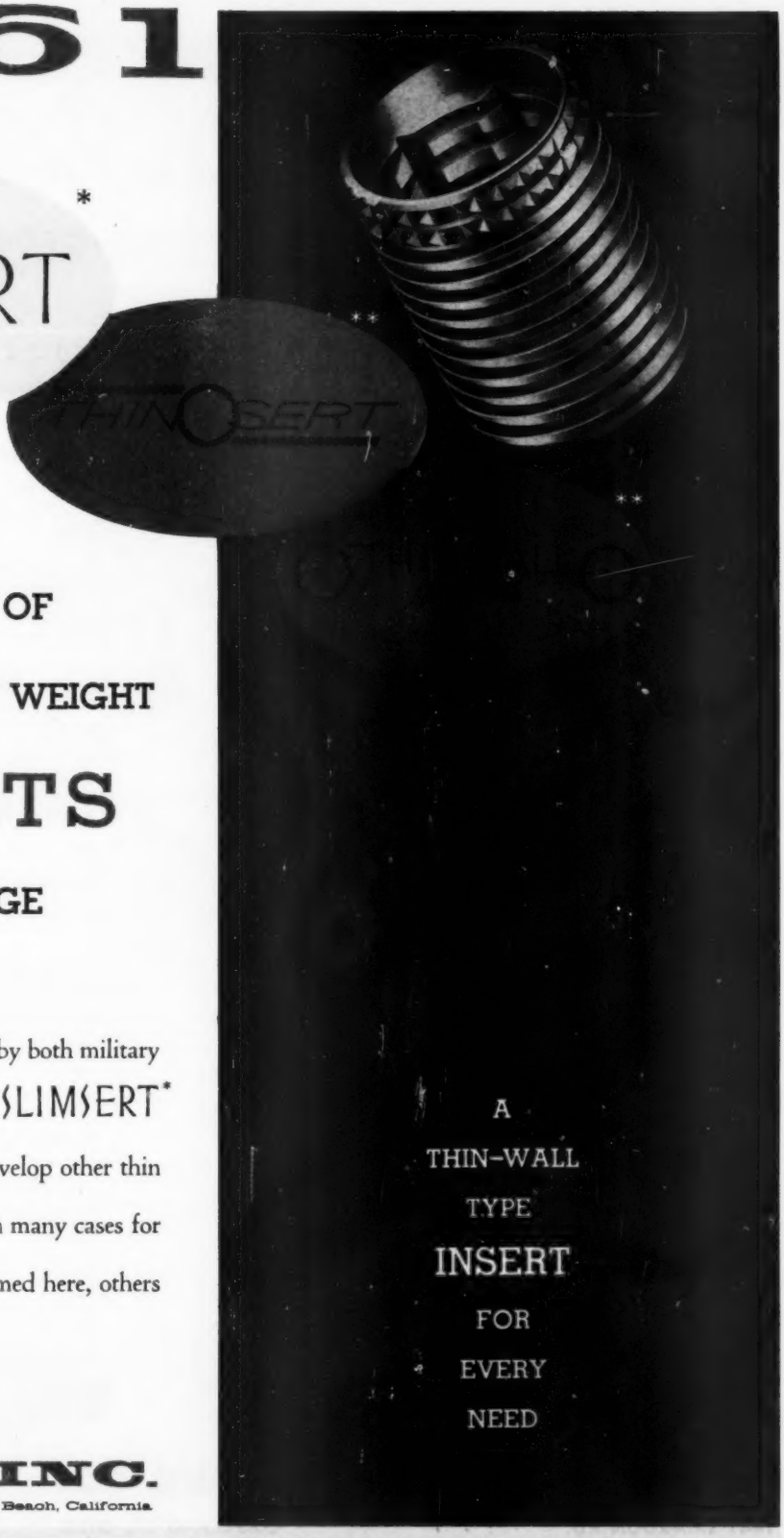
CAUTION

JANUARY IS OUR VERIFICATION MONTH

Please be sure to check your January issue wrapper!

1961

SLIMSERT*



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THIN-WALL, LIGHT WEIGHT

INSERTS

FOR THE SPACE AGE

The great acceptance by both military and commercial companies of our SLIMSERT* insert has made it necessary to develop other thin wall inserts of novel design and in many cases for special applications. Some are named here, others are on the design board.

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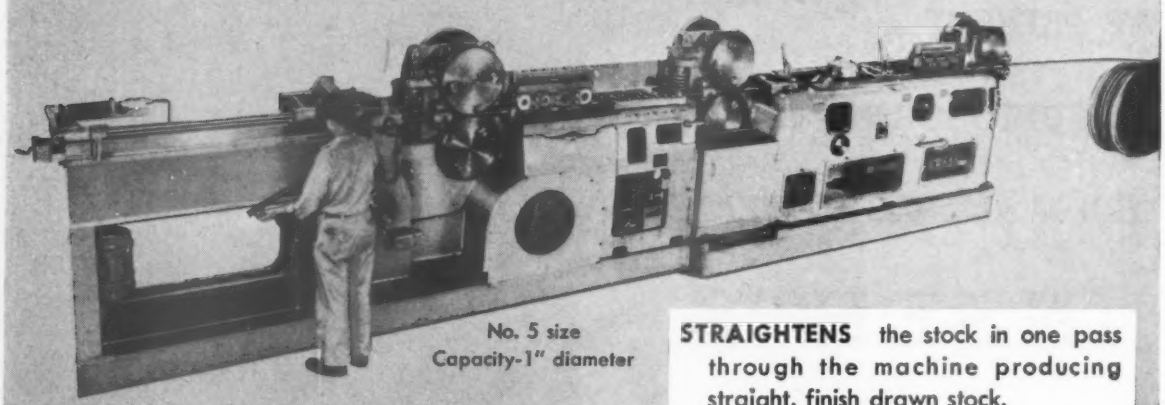
DRAWING-STRAIGHTENING AND CUT-OFF MACHINE

COLD DRAWS accurate diameter stock from coiled hot rolled rod. You save the differential between hot-rolled and cold drawn steel.



No. 5 size
Capacity-1" diameter

STRAIGHTENS the stock in one pass through the machine producing straight, finish drawn stock.

CUTS-OFF the finished stock automatically to pre-determined lengths with practically no distortion of the ends.

AJAX DRAWING-STRAIGHTENING and CUT-OFF MACHINES are now producing the blanks for these parts . . .

STEERING SHAFTS
POLE-LINE HARDWARE
DRAG LINKS
TIE-ROD ENDS
SPECIAL DIAMETER SCREW MACHINE STOCK
LONG BOLTS FOR ROD HEADERS
SUSPENSION BARS
SPECIAL AUTOMOTIVE HOT FORGED PARTS
(where grip and constant volume are essential)

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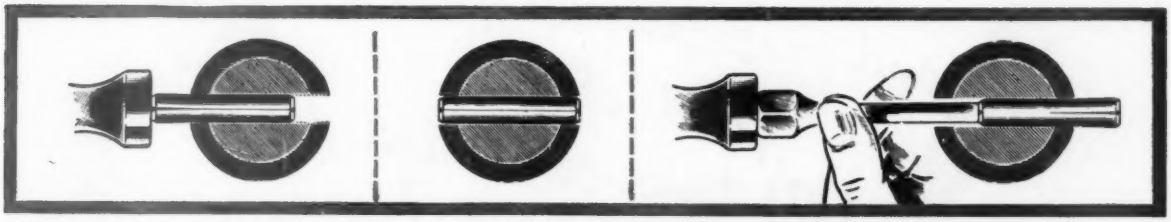
what makes this fastener DIFFERENT?

Several things. Rollpin® is a slotted, chamfered, cylindrical spring pin which drives easily into a hole drilled to normal production standards. It locks securely in place, yet can be drifted out and reused whenever necessary. This eliminates special machining, tapping, and the need for hole reaming or precision tolerances. Rollpin replaces taper pins, straight pins and set screws; for many applications it will serve as a rivet, dowel, hinge pin, cotter pin or stop pin.

And here's another difference that makes Rollpin the quality fastener in the field: ESNA's quality control builds consistent strength and performance into every Rollpin. Rollpin is uniform as to shear strength, dimensions, hardness, and insertion and removal forces.

HOW YOU INSERT IT



Drives easily by hammer, arbor press, or air cylinder and can be readily adapted to an automatic hopper feed. Requires only a standard hole, drilled to normal production-line tolerances.

Locks securely in place without using a secondary locking device; won't loosen despite impact loading, stress reversals, or severe vibration.

Removes readily with a drift pin without damage to pin or hole, can be used again and again in original hole.

HOW YOU SAVE

You pay less for Rollpins than for most tapered, notched, grooved or dowel pins. Installation costs are substantially less than for any fastener requiring a precision fit or secondary locking operations.

Because of their tubular shape, Rollpins are lighter than solid pins. Production maintenance is reduced with Rollpins: they do not loosen and because of their spring action they tend to conform to the drilled hole in which they're inserted, without material hole wear, eliminating the necessity of re-drilling or using oversize pins.

MATERIALS AND SIZES

Standard Rollpins are made from carbon steel and Type 420 corrosion resistant steel. They're also available in beryllium copper for applications requiring exceptional resistance to corrosive attack, good electrical, anti-magnetic, and non-sparking properties. Stock sizes range from .062" to .500" in carbon and stainless steels.

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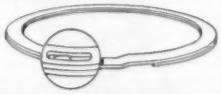
the unique 360° full-circle ring offers design variations that open unlimited opportunities for new and improved designs. Available in a variety of materials and finishes from .375″ to 48″ diameter.

SINGLE TURN RINGS
—for economy—light weight
Internal or external rings provide positive positioning or retaining for light thrust applications.

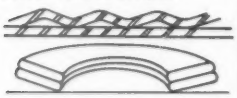
DOUBLE TURN RINGS
—medium—heavy—extra heavy duty
Available in varied thicknesses—3 standard series to choose from including the NAS 669/670 "deep groove" series.

MULTI-TURN RINGS
—extra heavy duty—spacers
Can be coiled to any diameter, any number of turns for heavy loading or as spacers.

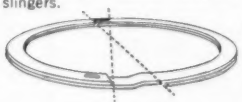
SELF-LOCKING RINGS
—one piece—positive locking
Locking action keeps ring in groove under high rotational speed, vibration, impact loading.



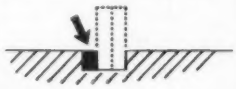
RESILIENT RINGS—allow large tolerances—end play take-up
Eliminate need for separate springs and washers—available in waved or dished designs.



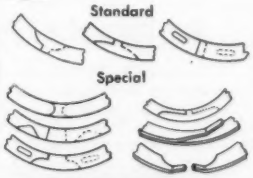
BALANCED RINGS
—for critical balance operations
Minimize dynamic balancing problems on shafts with statically balanced rings—make ideal oil slingers.



GROOVE GUARD RINGS
—reinforce ring groove
Single turn, high tensile strength rings greatly strengthen groove.



REMOVAL NOTCHES
—variety of end conditions available
Rings can be supplied with removal notches, slots, tabs, or hooks—round, square, bevelled or tapered edges.



Spirolox Rings have no lugs or projections — uniform wall allows installation with minimum clearance — no special tools are needed for installation or removal. Prototypes require no special tooling or set-up charges. Spirolox lends itself to deep groove design to withstand greatly increased thrust load. Covered by Government Specifications MIL-R-27426 for usage under Government contracts. Ramco engineers will be glad to work with you on the solution of difficult problems.

or—you may find the answer in *the improved die-formed retaining ring.*

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- Easily installed or removed.
- Available in a variety of materials.
- Wide choice of finishes available.
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- Meet Government and Industry Standards.

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Got a problem that calls for thread-cutting screws?

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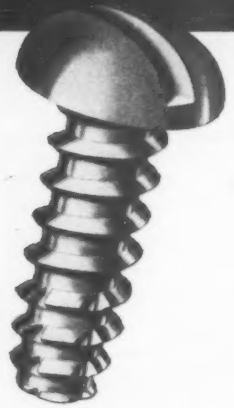
1 New, Improved P-K Type F*

. . . hardened thread-cutting screws developed for use in friable, granular or brittle material. The pilot, with its five tapping flutes, cuts a machine screw thread as the screw is turned in. The Type F is ideal for making fastenings to ferrous and non-ferrous castings, bronze or brass forgings, heavy gage sheet metals, structural steels, plastics and resin-impregnated plywood.



2 "Pentap"... the new, Improved P-K Type B-F*

(formerly F-Z) combining the five thread-cutting flutes of the Type F screw with the coarse-pitch, widely-spaced threads of the P-K Type B. The thread-cutting "Pentap" Type B-F distributes cutting pressure evenly, lets chips drop to the bottom of the hole, and prevents cracking of material. It is designed for making fastenings to comparatively thin sections and bosses in friable and brittle plastics.

3 P-K® Type L†

. . . is a completely new and improved thread-cutting screw developed by Parker-Kalon especially for use in Nylon. The Type L functions as a combination thread-cutting and thread-forming screw in that it cuts a small amount of the Nylon to allow the full diameter threads to form. Type L offers a particular advantage in Nylon assemblies which must be disassembled for service, because *the P-K Type L can be removed and replaced without stripping or galling.*

The five cutting flutes on the new, improved P-K Type "F" and "BF" reduce pressure development by 80 percent! The completely formed threads on these screws have sharper cutting edges, and 5 deep flutes that are of continuous depth. These features make for better clearance of the accumulated material and assure minimum stresses in driving, and avoid the possibility of stripping or galling.

FOR SEMS . . . and Neoprene or Nylon washer **STAPS®** in thread-cutting and thread-forming tapping screws, or machine screws in any kind of pre-assembled fastener-washer combination, P-K can supply them, too.

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*Patent Pending †U. S. Patent 2,350,346

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THE EDITOR'S VIEW

JANUARY, 1961, VOL. 4, NO.1

OUR CHALLENGE IN THIS DECADE IS TEAMWORK—NOT IMPORTS

For those concerned with chronological details, 1961 represents the start of what has been hopefully dubbed the "sensational sixties."

This is the decade when our big crop of war babies are supposed to start forming their own family units, creating a tremendous new market to keep our assembly lines humming.

But the decade is losing its bloom while still in the budding stage. Unemployment is rising in an unseasonal trend.

Rising imports and falling exports are being blamed for declining jobs in various American industries. I cannot argue with this. But aren't imports only a symptom of what is wrong with our economy—lethargy and a lack of teamwork on the part of American industry?

Now, just suppose that so many Americans lose their jobs because of imports that we have our worst recession in years. Then our nation's purchasing power will dwindle to a fraction of what it still is today. Imports will suddenly cease, but our unemployment problem will not. Then, we'll really have to put our shoulders to the wheel in teamwork. But why wait until then?

Everyone is aware of what full employment can mean to any nation's economy. Just think what purchasing power 180,000,000 Americans would have should the heads of all households be gainfully employed!

But too many of our companies, both large and small, are blithely going their own way, squeezing a few more cents out of their costs by buying imported fasteners, components, materials and equipment. And why, so they can build fewer and fewer products which they hope to sell to fewer and fewer employees of their former American suppliers.

How blockheaded are we that we cannot see the end of the road ahead? We had better rid ourselves of lethargy, and start pulling together as a team, or we won't be able to afford even the cheapest of imports.

Matt E. Hensley

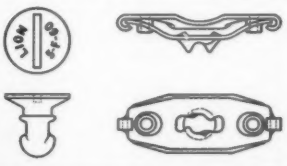
Editor

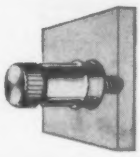
Captive Quick-Opening Fasteners:

Southco standards provide many benefits at low cost for access through doors, covers, panels and into drawers

LION ¼ TURN FASTENERS

Quick, positive locking, by fractional turn. Tight seal formed by compression of leaf spring. Alignment and stack height not critical. Approved for aircraft use. Rugged. Extra strength provided by swaged nose. Vibration resistant.





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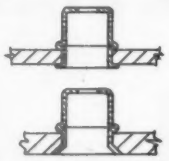
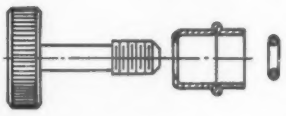
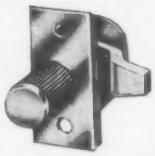
Stand-off thumb screws from stock to eliminate costly, special fasteners. Installed quickly without special tools. Accommodate misalignment. Complete range of standard sizes.

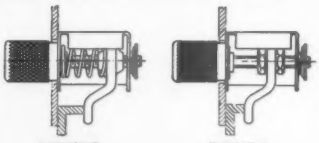


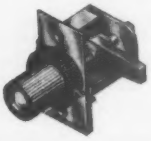




ADJUSTABLE PAWL FASTENERS

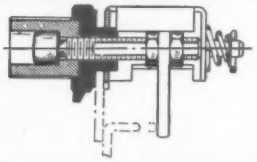
Pre-assembled, quickly installed. Accommodate variations in frame thickness up to ½ inch. One-quarter turn closes, additional turns increase grip pressure. Attractive appearance, long life. Moving or pre-set pawl. Miniature, intermediate and large sizes.





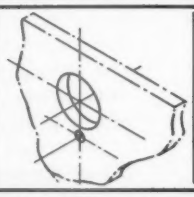
ADJUSTABLE PAWL FASTENER

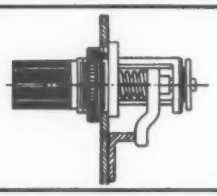
Has twin-knob control. One knob controls pawl, pointer shows pawl position. Other knob controls amount of pressure to seal closure with uniform pre-set compression. Easily installed.



ADJUSTABLE PAWL FASTENER

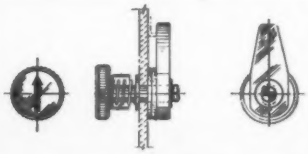
Compact and rugged. Eliminates rivets or bolts to save installation time. Three types cover grip range up to ¾". Supplied either with integral metal and plastic knob, plastic knob or for your knob.





ARROWHEAD DOOR LATCH

Requires only one hole to install. Operates on quarter turn. Holds under spring tension. Arrow shows pawl position; no pawl stops required. Uses minimum inside space.



Free Fastener Handbook

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SOUTHCO FASTENERS

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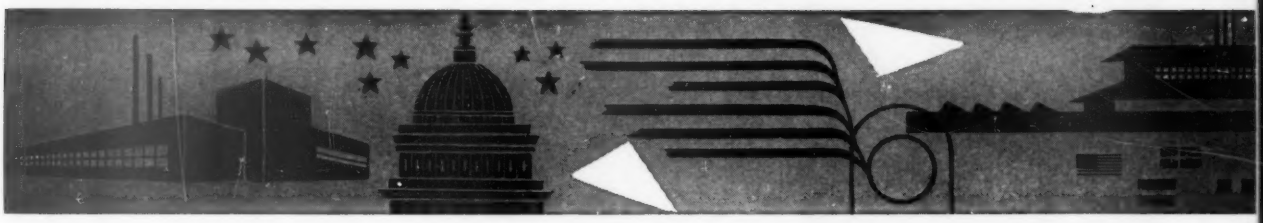
The State of Business



OUTLOOK FOR 1961 . . . DOWN . . . THEN UP

By **Dr. George Cline Smith** and Associates—F. W. Dodge Corp.

At the beginning of 1960, most economists predicted a downturn in business by the second half of the year. It has been popular to ask "Whatever became of the Soaring Sixties?" A few pessimists have been heard to refer to the "Sagging Sixties" or the "Souring Sixties." Yet, few competent observers argued that the sixties were going to be a steady zoom, devoid of dips. In fact, nearly unanimous opinion held that the first half of the decade would have less zip than the second half. However, this has not diminished the opinion that the Gross National Product by 1969 would be around $700 billion (in constant dollars) compared to about $500 billion in 1960.

What may be happening in business today does not affect these estimates. The fact is that during the sixties, business in general is going to be colossal. What is different is that competition among sellers will be fierce, and that buyers will be more coy and elusive than they were in the post war period. There will be plenty of business, and plenty of profit, but it will go to those firms who do the best job of identifying, locating, studying, reaching, intriguing and selling their customers.

BUSINESS IN 1961

Every year, about this season, one begins to hear an old refrain: "Never has there been a time when it was so difficult to forecast." And as a further note, we offer this helpful comment from a leading economist: "Business is ready to move—in either direction."

The fact of the matter is that one cannot look at the current business situation and come to any other conclusion than this: There are many signs of weakness, enough to add to some downturn in economic activity in 1961.

There are good grounds for believing that it will follow the 1958 pattern in many respects and that it will be neither very long no very deep.

Perhaps the most important point is that we have already had a considerable readjustment in many industries. All this is not to refute the prospect of a downturn in business. It is in process. But it appears that the first half of 1961 will see the low point, and that the second half is likely to bring a decidedly brighter look to the scene.

A composite of opinions of 327 of the nation's economists give the following picture on some of the specific points of the economy for 1961.

GROSS NATIONAL PRODUCT

The GNP will inch gently upward from the $505 billion in the second quarter of 1960 to $507 billion by the second quarter of 1961, and then move ahead more sharply to $515 billion by the fourth quarter of the year.

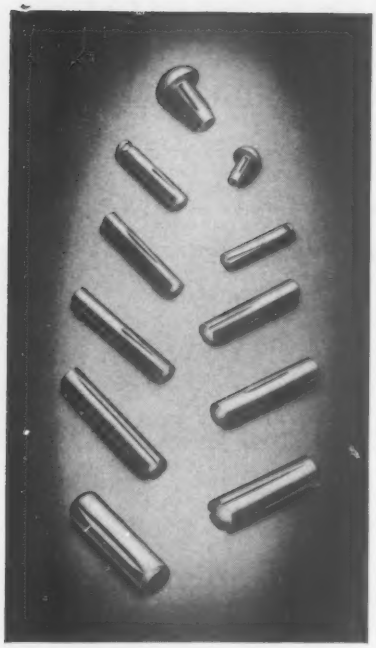
INDUSTRIAL PRODUCTION

The expected dip in economic activity in the months ahead is more clearly reflected in the economists' forecast on industrial production as measured by the Federal Reserve Board index. On a seasonally adjusted basis, the index stood at 109 in June, 1960, (1957 - 100). Expectation is that production will drop to 108 by December, 1960, then down to 107 by June, 1961, after which it will rise moderately to 110 by the end of the year.

Industrial production is forecast to dip more perceptibly than GNP chiefly because of two factors. First, the index of industrial production is in terms of physical volume while GNP is measured in terms of dollars. Since the average expectation is that prices will continue to rise, although slowly, during the forecast period, the increases will tend to raise the GNP level without affecting the industrial production index.

Secondly, and more important, there seems to be rather general agreement that manufacturing in-

continued



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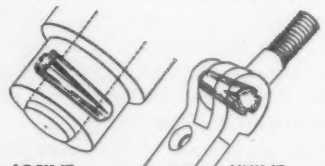

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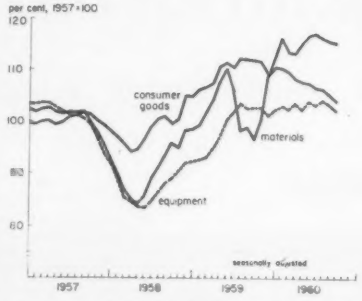

Production of materials has declined since early this year
—courtesy Fed. Res. Bank of Chicago

dustries will bear the brunt of the recession, reflecting plant and equipment cutbacks and inventory corrections.

CONSUMER PRICES

Consumer prices will continue to rise through 1961, even though at no more than a "creep", with the consumer price index at about 128.0 by December, 1961, barely one per cent above mid-1960.

WHOLESALE PRICES

Wholesale prices will inch up in 1961, but by less than the increase in consumer prices. By December, 1961 the index is estimated to be 120.0, one half per cent above the June, 1960 mark.

TOTAL NEW CONSTRUCTION

Construction has probably reached its low point, and is due for a slow recovery, picking up speed by the second half of 1961. Leaders in the recovery movement will be residential building and public works, while nonresidential building will slacken.

NEW PLANT AND EQUIPMENT

New plant and equipment expenditures will decline somewhat in 1961. However, the whole range of forecasts are very wide. The general median forecasts are for $35 billion for both halves of 1961 on a seasonally adjusted rate. This compares with an estimated rate of $36.9 billion for the second half of 1960, or a decrease of about 5%.

AVERAGE HOURLY WAGES

One economist, after checking "up" on the survey blanks in regard to this question, summed up the feeling of a healthy majority with the simple question: "Where else?" Quite a few economists agreed that wage increases would be modest this year.

PERSONAL CONSUMPTION

Old Reliable, personal consumption expenditures, will climb to a new high in 1961, recession or no recession. By the second half of 1961, expenditures will be at a seasonally adjusted rate of $336 billion, compared with about $330 billion in the second half of 1960.

MONEY AND INTEREST RATES

An overwhelming majority of economists look for relative stability in interest rates through 1961. However, a good deal gave the opinion that the international financial climate and continued outflow of gold will hamper efforts of the monetary authorities to ease credit generally. •

Edited from an economic survey prepared by Dr. George Cline Smith and Associates, for the F. W. Dodge Corporation, entitled "New Game, New Rules."

Business Briefs

Major appliance manufacturers expect a 4% increase in factory sales of home laundry equipment in 1961.

Based on forecasts made by industry market research departments, sales of combination washer-dryers are expected to increase by 23%, automatic washers by 3%, gas dryers by 9% and electric dryers by 5%. The only home laundry unit expected to register lower sales is the wringer washer. •

Are the factors used in computing the consumer price index outmoded? The Bureau of Labor Statistics has launched a new survey of the kind and amounts of goods purchased by U.S. families.

BLS officials suspect, for example, that the increasing teenage population has altered many of the family budgets for clothing expenditures. Also, that increased use of the automobile as a necessary means of transportation to and from work may be requiring more consideration in computing family living costs. •

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the automatic torque control tools that made industry stop, look and examine their methods of setting screws, nuts, and bolts.

Clecomatic No. 10 Series Screwdriver– Nut-Runner

Clecomatic Right Angle Nut-Runner

Clecomatic® No. 10 Series Screwdriver—Nut-Runner: These are the tools that enable you to set torque to the most critical specifications . . . then forget it. Torque is positively maintained by a no-drift locking device. A long wearing, non-friction clutch is quickly adjusted when torque change is desired. *This is the only torque control air tool that starts and stops automatically!* Operator merely engages the screw with bit, the tool starts. When torque is reached, the tool stops. Motor operates only during rundown. Less air is used. Wear is reduced. There is no quality let-down at the end of a shift because control is in the tool. This tool has little impact, is shorter, and weighs less than competitive tools. No. 10 Clecomatic Screwdriver—Nut-Runners are available in pistol grip or straight handles in speeds from 400 to 2,900 r.p.m. Reversible or non-reversible.

Clecomatic Right Angle Nut-Runners: You get uniform tightness in every nut or bolt rundown with a Clecomatic 14 or 16 Series Nut-Runner. Torque is preset. When specified foot pounds are reached, air is automatically shut-off at the driving spindle. The hazardous, tiring torque kick usually found in tools of this type is substantially reduced, your operators can produce more without extra effort. As for maintenance, there's practically none. Cleco's non-friction clutch operates for very long periods, completely maintenance free. Torque adjustment is made externally, no need to disassemble the tool. Clecomatic Nut-Runners are available with both recessed socket heads and double-end spindles (reversible). Speeds range from 250 to 1,000 r.p.m.

NOW AVAILABLE! Clecomatic No. 6 Series Screwdriver—Nut-Runners: Essentially the same tool as the Clecomatic No. 10 Series—but smaller and lighter. No. 6 Series is equipped with the same unique torque control principle. The same automatic start and stop mechanism. They enable you to make even greater cost savings in the production line operations of automotive, aircraft, appliance, and electronic industries. Clecomatic No. 6 Series Screwdriver—Nut-Runners are available for delivery.

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LOWER FASTENER COST

with JOB-DESIGNED COLD HEADED PARTS and FASTENERS

what The most important consideration we can point out to the designer or purchaser of fasteners and small parts is that any part which can be machined from rod stock is also potentially available from the cold heading manufacturer. This technique offers speed of production, without scrap loss, plus superior strength and appearance for low cost and high design efficiency.

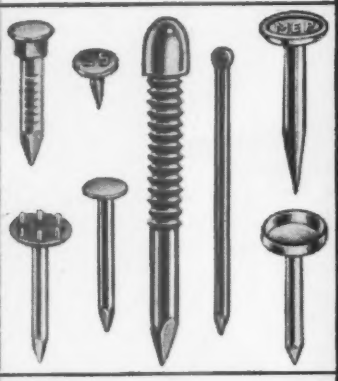
why The designer need not be restricted to standard fastener sizes when they do not meet the requirements of his application. It is often much less expensive to specify a rivet, nail or screw to meet the task exactly as the application requires, than it is to compromise its function for the sake of "standards". In this regard, we offer the equally important advantages of flexibility according to our customers' design changes and production by high speed, quantity techniques. While the really spectacular advantages in cost show up in runs of several thousand pieces, we are also able to take care of your short run requirements. We welcome and expect manufacturers to come to us for advice and assistance concerning their fastener problems.

how Given complete specifications, including a drawing and an idea of the application, we can quickly tell you whether or not it will be advantageous to have your fastener or part JOB-DESIGNED by HASSALL. The remaining important aspect of our service to you is the ability to get into production quickly and make prompt shipment.

Send today for your copy of our new booklet "What the Designer Should Know About Cold Heading".

RIVETS

It is sometimes difficult to realize that the proper rivet of the proper metal designed specifically for your application often costs less and is more easily obtained than so-called "stock sizes." JOB-DESIGNED rivets—countersunk, shoulder, tubular, etc., in any metal—have solved countless problems for our customers.

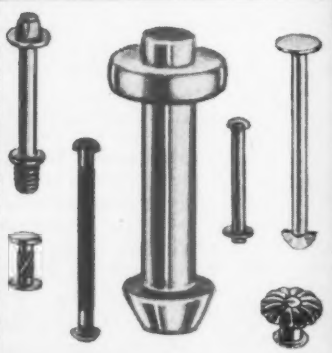


NAILS

Manufacturer of "standardized specials" would be an apt description of HASSALL products in this field. Many of the nails were JOB-DESIGNED for a specific application but universal acceptance of their extremely functional advantages has put them in the standard classification.

THREADED PARTS

There is a wide scope of design possibilities available when your fastener or part is threaded, fluted, or knurled by the high speed cold rolling technique. The strength characteristics of the part are not penalized in this process as in the case of cutting the surface grain by machining.



DOUBLE HEADING

The old saying, "Two Heads are Better Than One", may well apply to your part or fastener requirements. The savings in scrap when compared to machining from bar stock are often spectacular for obvious reasons. A glance at the illustration may bring to mind possibilities for parts you have considered previously only for screw machining.

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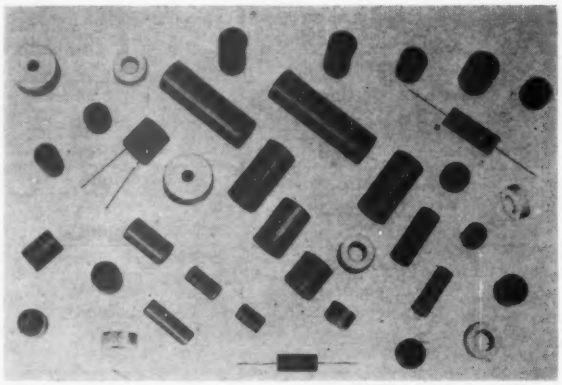
Ideas and Field Reports

EPOXY ENCAPSULATING SYSTEM HELPS CUT COSTS ON SEMICONDUCTORS

USE OF proper hardener is key factor in formulating an encapsulating system. The amine equivalent of each lot of hardener is independently determined. Here a sample is being weighed prior to examination.



VARIETY OF PELLET sizes available in encapsulation system designed for high-volume, low cost production of electronic components.

A new system for encapsulating components such as diodes has been developed to permit production economies without impairing quality. A patent for the system granted to Epoxy Products, Irvington, N.J. uses a dry, one-component, non-toxic epoxy system cured by the application of heat alone.

Manufacturers of miniaturized semiconductor devices for the communication industry may now be in a better position to meet-cost-competition. At the same time, the new technique simplifies inventory requirements and permits faster deliveries.

Designed for high-volume, low cost production, the system is based on pre-measured, pre-weighed epoxy resin pellets, shells, and headers. The shells included in the system are molded of a thermosetting epoxy resin composition. One formulation is flameproof. They are open at one end. Since their internal dimensions are greater than the external dimension of the electronic component being packaged, the component can be positioned in the shell without difficulty.

NO MOLDING PRESSURE NEEDED

When heat is applied, an inserted pellet liquifies and completely fills the space between the shell and the component. No molding pressure is needed.

This approach to encapsulation permits the manufacturer to stock a supply of packaging materials in the form and in the exact quantities in which he will need them. Since the process is accomplished by heat, system components remain under refrigeration until used. When kept cool and dry, their shelf life may be as long as six months. Several formulations are room-temperature stable.

The system, called the "Epoxy-E-Pak" uses hardeners developed by the Smooth-On Manufacturing Co.

In addition to savings in terms of production and inventory, the new system is designed to speed up deliveries, even if changes in specifications are frequent. If the size of a basic electronic unit must be changed, the size can be altered simply by over-

continued

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Right-Angle Drills

. . . and where production line performance stands out consistently you're apt to find Airetool air powered equipment. Compact and sturdy, like the new cars, Airetool pneumatic production tools are engineered to deliver top-notch, 'round-the-clock production with little maintenance.

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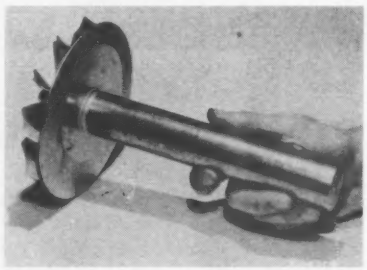
packaging. An extra layer of epoxy encapsulation does not harm the performance of the component, but, on the contrary, enhances it through added insulation.

TURBOCHARGER COSTS CUT BY BRAZING DISSIMILAR METALS

Assembly costs in the manufacture of a wheel and shaft assembly used in a diesel engine turbocharger have been cut 25%. The reduction was made possible through the combination of dissimilar metals.



The part was produced originally with the wheel and shaft integrally cast of stainless material. This was a high cost design, partly because of the material, but mostly because of shaft machining costs. In the new design, a mild steel shaft is brazed to a wheel which is cast of cobalt-chrome-nickel stainless alloy.

Despite skepticism regarding chances of success because of the dissimilarity of metals, six prototype parts were produced by the Wall Colmonoy Corp. The six test pieces were produced by production assembly techniques, to give credence to subsequent testing.

Successful laboratory and field testing proved the design equal to or better than the previous design in terms of strength, dimensional accuracy and corrosion resistance where needed.

Savings in material and other economies effected a reduction of 25% in assembly costs, and additional savings resulting from the ease of machining of the mild steel.

Dimensional tolerances are held to a plus or minus .002" total shaft runout.

TIMER GIVES ACCURATE PRODUCTION DATA

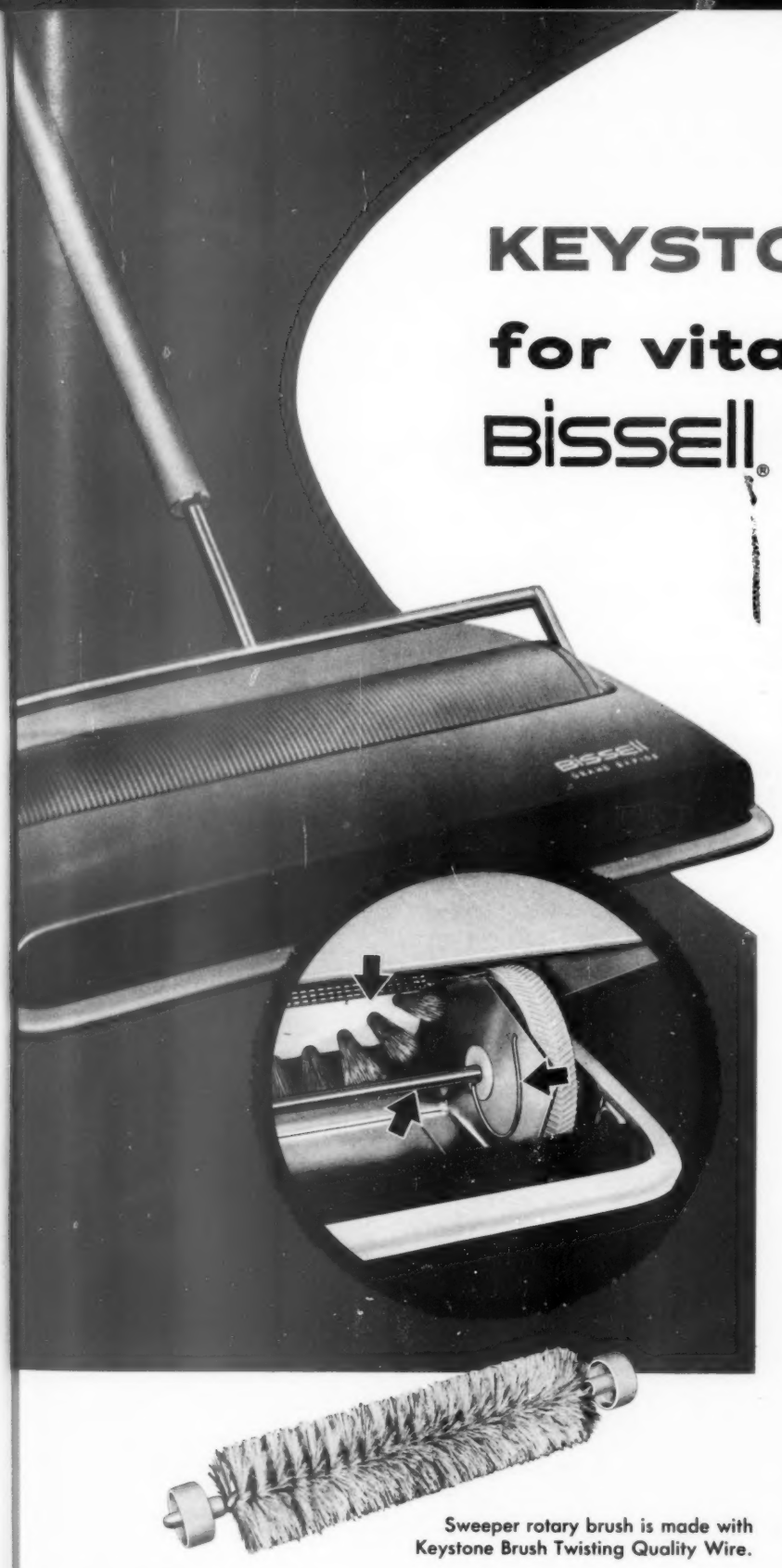
Incorrect cost estimates on assembly operations or production runs can be expensive. The cause of such errors lies in the stopwatch or timer selected to obtain the standard time data for an estimate.

A basic rule suggested by timing analysts of the Heuer Timer Corp. is to first select a dial execution with the largest division obtainable for an individual timed operation. Then, select a movement that will indicate a total elapsed time approximating the maximum duration of the operation.

To aid in correct timer selection, the chart lists the standard available dial increments for one complete revolution of the second hand with total recording available for those increments.

Group Number	Timer Duration Max. Individual Element	Total Recording
1	1 second	2 minutes
2	3 seconds	3 minutes
3	3.6 seconds	2.4 minutes
4	6 seconds	3 minutes
5	10 seconds	6 minutes
6	30 seconds	15 minutes 30 minutes
7	36 seconds	36 minutes
8	60 seconds	15 minutes 30 minutes 60 minutes 12 hours
9	100 minutes	50 minutes
10	60 minutes	to 12 hours

KEYSTONE WIRE
for vital parts of BISSELL® Sweepers



Sweeper rotary brush is made with Keystone Brush Twisting Quality Wire.

Bissell Inc., world's largest manufacturer of carpet sweepers, with a global reputation for quality, specifies Keystone Wire for the vital parts of their Bissell Carpet Sweepers.

In this popular model, the axle rods are made of Keystone Silver Brite Galvanized Wire; the sturdy brush bristles are anchored in a solid wood roller with staples made from Liquor Finish Stapling Wire. Keystone high carbon Spring Wire is specified to absorb the flexing action of the wheels.

Walter Bradcoski, Senior Buyer, says, "Keystone Wire has always met our requirements exactly and is used in all our sweepers."

Keystone Wire Specialists have developed wire with correct thermal treatment, chemical analysis, surface and uniformity for Bissell Sweepers. These metallurgical engineers who know wire thoroughly, are always ready to offer you their experience to help you modernize your wire needs. They will recommend the wires best suited for your requirements. Call them soon...it could be a profitable contact!

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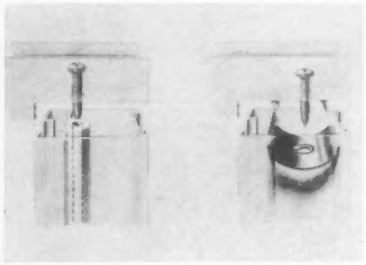
SPRING FASTENER CUTS WINDOW ASSEMBLY COST

By designing a new means of fastening aluminum window frames, considerable material costs were saved and assembly simplified.



To provide a fastening base for a self threading screw, earlier designs specified a half-round aluminum strip in the side and end frames. This was a solid part of the extruded channel and extended the entire length of the frame. Only ¾" of its length was used. The rest of the solid aluminum was an added cost, and served no mechanical purpose.

The half-round aluminum strip was replaced by a rectangular, dish-shaped, aluminum spring fastener with two square edges. Desinged by the George K. Garrett Co., the Channeloc fastener is specially hardened for optimum resiliency.

In fitting the frame assembly, tightening the fastener with a self-tapping screw compressed the dish-shaped fastener, causing the square edges to bite into the aluminum channel, securing both frames together.

The new design simplified the extrusion die, and further cost savings were effected by substituting the more expensive self-threading screw with a self-tapping screw.

SHRINK-FIT UNIT DESIGNED FOR COMPRESSOR UNIT

Equipment that shrink-fits three units of an air-conditioner compressor unit and insures its hermetic seal, has been designed and built by Induction Heating Corp., for the Carrier Corporation, Syracuse, N.Y.

Requirements of the automated equipment were that it would shrink-fit the rotor on the crankshaft, the stator in the crankcase housing, and the manifold cover or shell on the crankcase housing.

Other requirements were that the three step procedure had to be incorporated directly into a high production assembly line and that no operation could require more than one minute.

SHRINK-FITTING of stator to crankcase. The crankcase itself is induction heated and expanded so that motor stator can be pressed into position around the rotor.

MOTOR ROTORS are shrink-fitted in first step of three-stage, high production assembly line. Here rotors on turntable are revolved automatically through three stages of induction heating.

Using induction heating which heats the rotor only, the rotor is transferred to the assembly station by means of a hydraulically-operated electro-magnet.

The installation produces more than 60 assemblies per hour, and requires about 36 sq. ft. on the plant floor.

The compressor unit assembled by the equipment is called the Micromite. It will be used in higher capacity room air-conditioners and in central units for homes and small commercial establishments.

Garrett OF PHILADELPHIA

custom designed SPRING FASTENERS come to grips with those tough problems

Of course you'll want more than just imagination when you need a spring fastener designed for your product. You'll want a thoroughly dependable source . . . you'll want consistently high quality . . . you'll want on-schedule delivery . . . you'll want superior service!

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- Skilled, imaginative engineers expertly design special fasteners of unusual design for O.E.M. applications.
- Special design samples are available promptly from our Research and Development Department.
- Flat nuts, "J" nuts and "U" nuts are stocked in ample quantities and sizes, both cone and twin-prong impressions; also rectangular and round push-on nuts.
- Quality is rigidly controlled . . . at every step . . . using the most precise techniques.
- Every manufacturing step is performed in the GARRETT factory . . . under one roof. Nothing sub-contracted . . . no divided responsibility.

For further information, write GARRETT . . . THE MOST COMPLETELY INTEGRATED PLANT IN THE INDUSTRY.

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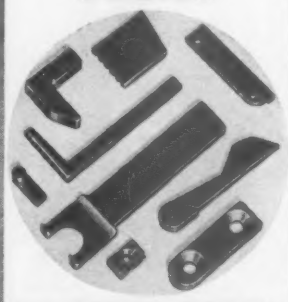
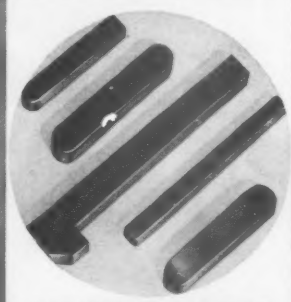


MACHINE PARTS



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HOW SCHICK "FILES" ELECTRIC SHAVER PARTS

Faced with the problem of stocking 300 different types of electric shaver parts with an inventory running well over one million items, Schick Inc., of Lancaster, Pa., "filed" them.

The tiny, fragile items had to be stored to prevent damage, losses, confusion, and provide a workable inventory control.

Standard fibre trays, made by National Vulcanized Fibre Co. were mounted drawer-style on steel racks and shelving.

Four sizes of trays are accommodated on the tray shelves, and parts are stored according to size in numbered trays.

When a shipment of parts arrives, it is immediately transfered to a numbered fibre tray which is then marked with a part number and description. This information is then entered in the central material control system. Since the trays are kept in numerical order, needed parts are located instantly. The system operates with the speed and efficiency of a giant file cabinet.

The central material control system has been extended to cover a problem inventory at low cost without drastic revamping of inventory methods.

By eliminating the various sized boxes and containers used previously for storing the parts, 800 sq. ft. of floor space was gained.

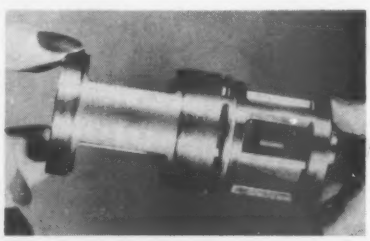
ADHESIVE CUTS METAL STAMPING COSTS

Efficient operation of a steel-rule metal stamping die capable of cutting through steel plate 1" thick has been extended by bonding certain of its components with Eastman 910 adhesive. Components involved are neoprene strips, acting as ejector springs to release parts and scrap after stamping has been made. The strips are bonded to metal and wooden die base plates.

Templet Industries, Inc., of Brooklyn, N.Y. has been able to produce the inexpensive, high strength steel-rule dies based on a patented technique. Formerly considered only for stampings of soft materials such as plastics or leather, steel-rule dies are now replacing conventional machined dies for heavy stamping with a savings in tool costs of up to 90%.

SPECIAL CUTTING TOOL BIT LOWERS ASSEMBLY COSTS

A small assembly which operates thermostatically to cool the lubricating system of jet planes is being turned out faster by the use of a special tool steel.



The two-piece assembly is produced from bar stock of corrosion resistant stainless steel. The parts must be hollowed out, shaped and machined with 11 openings of various sizes.

The Thaler Machine Co., Dayton, Ohio was turning out 10 assemblies to a cutting bit until they switched to a special tool cutting material made by Allegheny Ludlum Steel.

An average of 300 assemblies can now be turned out without the necessity of delaying production by changing the cutting bits.

The special tool is designed for heavy cutting duty and develops maximum red hardness. It retains its hardness despite friction heat generated during machining operations.

Setko's 23 Years of Progressive Engineering Experience Keeps Screws Modern as Tomorrow's Products

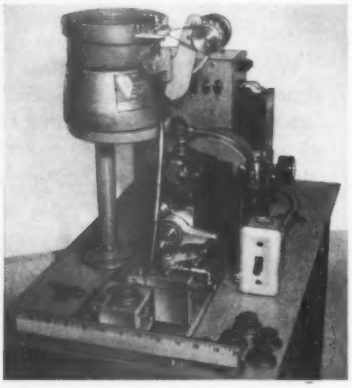
SETKO NEWS

We Specialize in Solving Puzzling Screw Problems

Vol. 3, Issue No. 1 Bartlett, Illinois (Chicago Suburb) Progress Edition

NEW HOPPER FEEDER QUADRUPLES SET SCREW INSERTION RATES

Labor costs cut by 75%



Changeover from manual to automatic insertion of set screws is now easier and more profitable than ever. More profitable because this new, compact, Setko Hopper Feeder requires less space — and embodies advancements and refinements in design to make for greater operating efficiencies. It is now possible to actually quadruple insertion rates over the hand method, while cutting labor costs by 75%.

Operation of the machine is less complicated than the hand method. All the operator has to do is feed the workpiece to the receiving pad and the machine automatically drives the screw to a predetermined depth. Every screw is uniformly inserted.

Additional savings result from a reduction in rejects and floor loss. Users report "rejects have been cut to almost zero and floor loss has been eliminated!"

More than fifteen years of experience in the design, engineering and manufacture of Hopper Feeders is behind the cost-cutting, production-increasing performance of this new model.

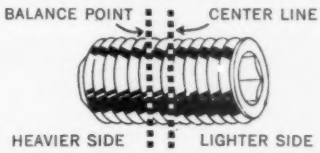
Feeds any type of headless set screw and with any point style

Hex Socket, Fluted Socket, Slotted or Slabbed heads and with any type point, can all be oriented and fed with equal efficiency. Even "specials" can be oriented in most cases.

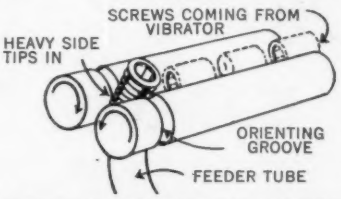
760

Exclusive orienting mechanism assures perfect positioning of screw every time

It's really a matter of balance... Every type of set screw has a point of balance. Because of the manufacturing methods used it is almost never exact center. This means that from the center of the screw, one end is a little heavier. The object is to get the heavier end to tip *consistently*



into the feeder tube. Setko accomplishes this by feeding the screws from the vibrator to the orienting mechanism *where it is literally wafted* on a cushion of friction between two opposingly driven rollers.

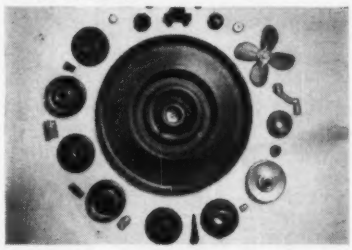


A groove in each roller acts as a balancing point so that no matter which way the screw approaches, head first or point first, the heavier end tips into the groove and falls into the feeder tube.

Many Models Available

In addition to the air-operated table top model shown on this page, Setko has a complete line of Hopper Feeders for use with vertical drill presses, etc. Various type driving and feeding mechanisms are available to assure the right combination for your operation.

Used on a Wide Variety of Products



Automated insertion of set screws is performed on these and many more products. The workpiece is simply fed to the receiving pad and the set screw is driven to a predetermined depth. In most cases the final tightening of the set screw takes place when the component is assembled to the main product. In some cases, the final inserting and tightening take place at one time.

Pays for itself in less than a year

Companies who have bought and are using Setko Hopper Feeders say that, "they pay for themselves in less than a year." In many cases, "much less than a year."

Send the Coupon Today for Full Information

Send your specifications for recommendations and quotations. Ask for Catalog 23 showing the full line of Setko Socket Screw Products.

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705 Main Street, Bartlett, Illinois

☐ Send me complete information on your Hopper Feeding Method.
☐ I am attaching specifications. Please send recommendations and quotations at no charge.
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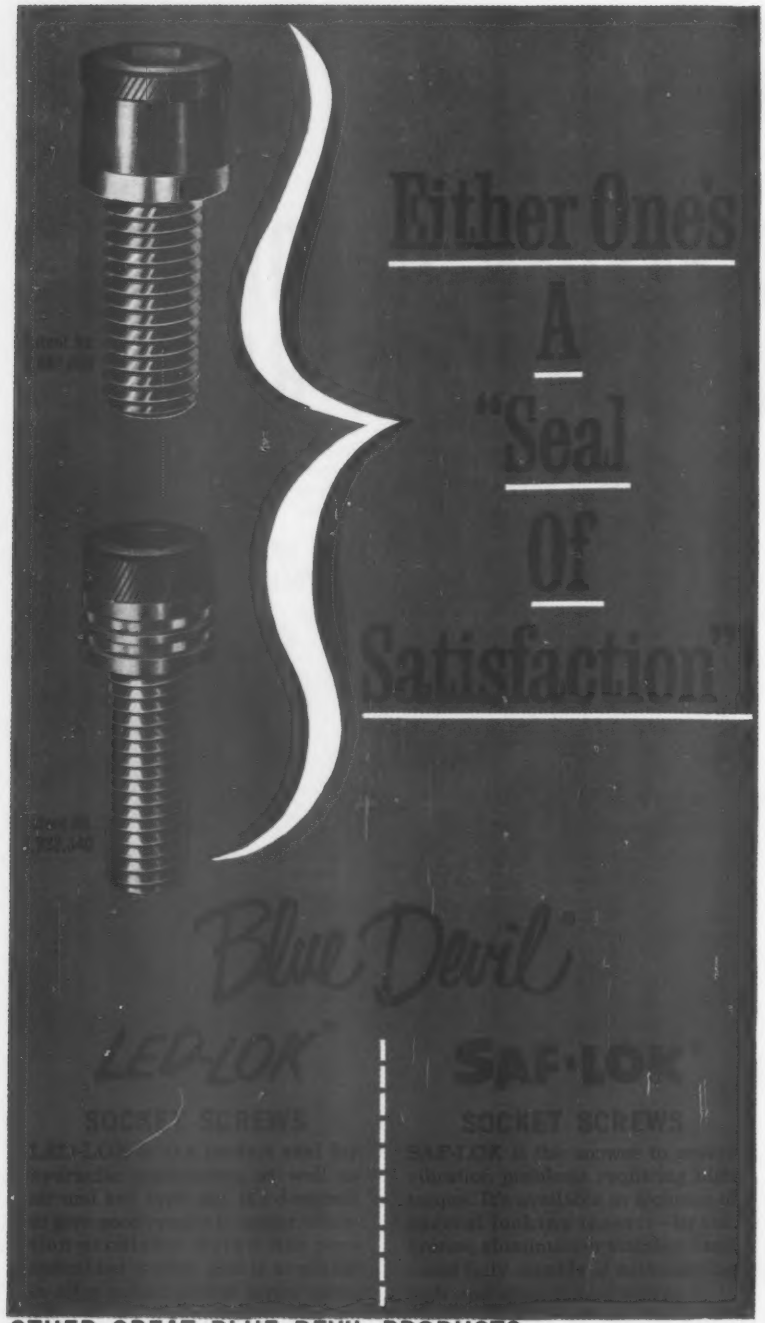

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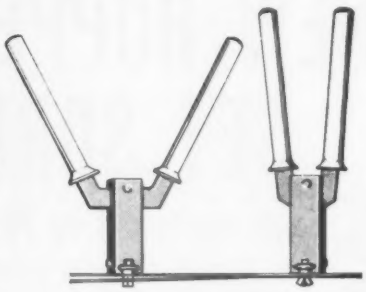
SQUEEZE RIVETER FASTENS THIN UNSUPPORTED SHEETS

A pocket-sized plier type tool makes it possible to rivet thin materials tightly from one side of the job with only hand pressure.

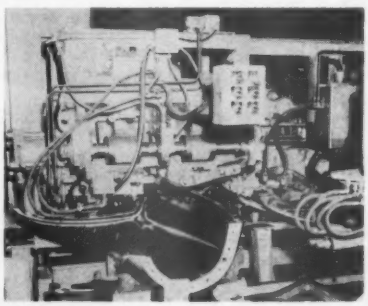


Developed by Southco, the squeeze riveter makes possible a low cost method of fastening clips, clamps and brackets to a variety of metals including wood, duct-work and neon signs.

The riveter is made in two diameter sizes, 1/8″ and 3/16″, with a nominal grip from .016″ to .266″. Equal pressure is applied against work side and blind side of material to push the sheets together and prevent deformation.

MODULAR UNITS IMPROVE ASSEMBLY AT CHEVROLET

By adding automatic, compact modules to its automated welding lines, Chevrolet's frame and stamping plant took full advantage of existing transfer systems.



HYDRAULIC DRIVE on hemming dies in compact module form close tolerance coach joints at speed gaited to basic stamping press at head of line.

Time-consuming routing detours and several manual loading and unloading steps were eliminated.

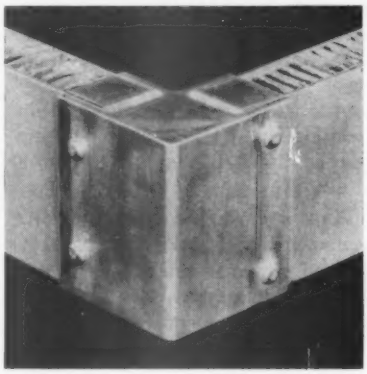
Replaced by modules were the heavy flanging and hemming presses on its hood and fender

sub-assembly lines. Both compact units were built by National Electric Welding Machines Co.

Chevrolet engineers list a number of advantages to the modular equipment. The units lowered initial tooling costs, saved approximately 50% floor space. There is less capital "throwaway" because the units can be rebuilt to meet model restyling. Savings in initial equipment costs are substantial over presses to do the same job.

But most important, the engineers say, is the flexibility the units provide. The equipment is smaller, weighs less and is more easily moved from one location to another. This maneuverability proves economical at model change time, when production routing is largely determined by car styling.

HIGH STRENGTH FASTENERS JOIN HONEYCOMB PANELS

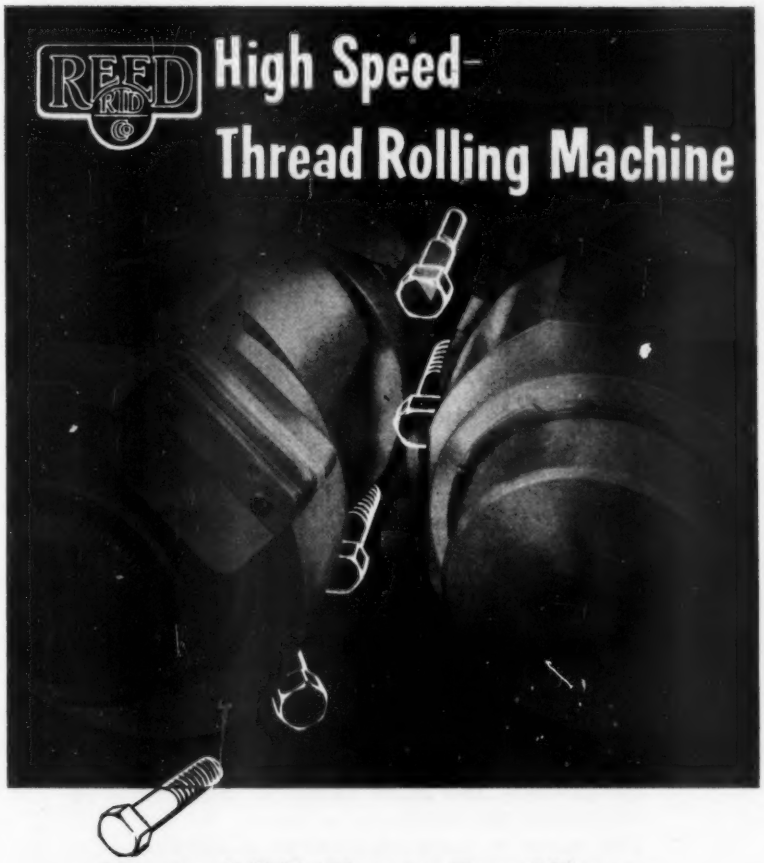


Exterior of cell corner section of missile launcher shows neat outer appearance. Honeycomb core panels of aluminum and fasteners of AISI 4037 alloy steel provide high strength-weight ratio.

Topside weight reduction in shipboard ordnance has been achieved without sacrifice of structural strength by maintaining an exceptionally high strength-weight ratio. This achievement was made possible through the use of aluminum honeycomb panels structurally joined with shear full tension alloy steel Huckbolts.

Developed by the armament division of Universal Match Corp., under the direction of the Naval Ordnance Testing Station at Pasadena, Calif., these high strength aluminum alloy skins, bonded

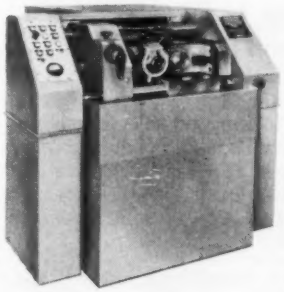
continued



Up to 200 Pieces Per Minute

with cylindrical single revolution dies

The Reed B910 Cylindrical Die Thread Rolling Machine is a rugged general purpose two-die type machine for high speed production. This machine is adaptable to a wide range of work using single revolution dies where the parts are rolled within one revolution of the dies. Diameters $\frac{3}{16}$" through 1" and thread lengths up to $6\frac{1}{2}$" long may be rolled.



The machine is simple to set up and convenient to operate. Both semi- and completely automatic work-handling equipment is available to take full advantage of the high production capabilities of the machine.

Write for Machine Bulletin B-910-1

REED RTD B-910-1

REED ROLLED THREAD DIE CO.

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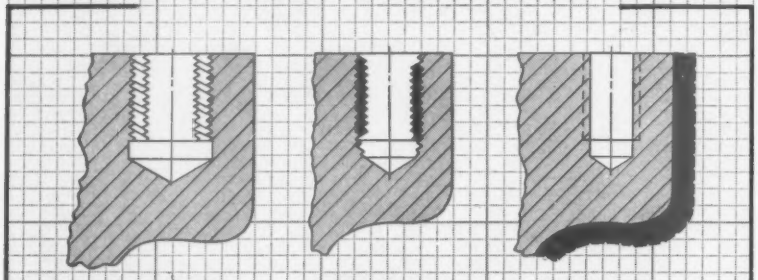
How You Can Save Boss Space and Weight in Thread Design ...with HELI-COIL® Inserts



Solid bushing requires oversize boss

Heli-Coil Insert permits standard boss proportion

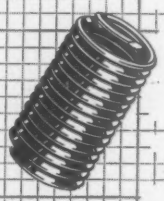
Space and weight saved by *Heli-Coil* Insert

As seen in the illustrations above, *Heli-Coil* Inserts save 56% in space, 63.5% in weight.

Heli-Coil stainless steel wire inserts have a smaller outside diameter than any solid bushing. Therefore, with ***Heli-Coil*** Inserts you can design boss radii to a minimum, yet stay with standard boss configurations. This means *savings in space and weight*, and material-savings as well.

This feature is vitally important for miniaturization in aerospace design, in electrical and electronics equipment design, and for general industrial applications.

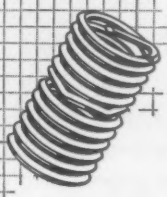
NO OTHER TYPE OF INSERT OFFERS SUCH SAVINGS!



Heli-Coil Standard Insert

for stronger, smoother, lifetime threads

Permanently protects threads against wear, stripping, corrosion, galling, seizing, vibration, and shock. Made of 18-8 stainless steel wire, this precision-formed ***Heli-Coil*** Insert has a tensile strength of approximately 200,000 psi. Conforms to military standards and all commercial and industrial thread forms.



Heli-Coil Screw-Lock Insert

eliminates lock wiring and lock nuts

This one-piece wire Screw-Lock Insert provides all the thread protection of the Standard Insert, PLUS an exclusive resilient *internal* locking feature that eliminates clumsy protruding lock nuts, lock wiring and other supplementary locking devices. *It saves cost, space and weight* — permits simple streamlined design in standard bosses. Meets military and N.A.S. specifications for locking torque and vibration.

The Heli-Coil line of products includes: inserts and related taps, hand tools, power inserting tools, automated tooling, and gages. Tables of boss radius and weight comparison are available. Write for complete details and design data. 2568A

HELI-COIL CORPORATION
3101 Shelter Rock Lane, Danbury, Connecticut
In Canada: ARMSTRONG BEVERLEY ENGINEERING LTD.
6975 Jeanne Mance St., Montreal 15, Que.

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with cores of aluminum, are fastened with bolts made from AISI 4037 alloy steel.

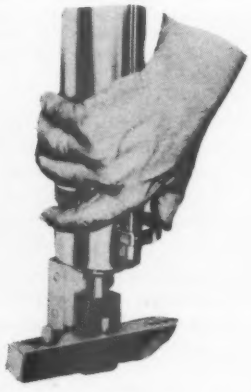
Use of 7075 aluminum skins prohibited fabrication by welding, since it is a precipitation hardening alloy. The localized heating associated with welding reduces the alloy's strength in the weld areas, causing possible embrittlement and loss of corrosion resistance.

The fabrication, used as an ASROC missile launcher, is an eight-cell pepper box design. All eight cells turn together, and each pair of over/under cells elevates individually. The magazines enable the ship to fire a succession of missiles at a throw of the switch.

PORTABLE FASTENER TOOL HAS VARIED APPLICATIONS

Riveting, dimpling, terminal lugging, light joggling and other operations normally performed on stationary equipment can be done with a new portable tool. This versatile pneumatic device was introduced by Wedgelock in November at the Los Angeles ASTME show.

Known as the Airdraulic squeezer, the tool features consistent power at all stages of the power ram's travel. It has been proved out in production at two large aircraft companies.



For the installation of anchor nut plates and similar fastener receptacles the tool will upset two ⅛" rivets simultaneously. Out-of-alignment conditions are no problem. Rivet installation time can be reduced by as much as 50%.

STAINLESS STEEL GASKET LASTS ENGINE'S LIFETIME

Type 304 stainless steel of .006 gauge is used in the metal core of a gasket that will last the lifetime of an outboard engine.

The gasket is now being used as a cylinder head gasket on a production basis for the 40 and 75 hp Johnson outboard motors. Future use in trucks, tractors, aircraft and automotive engines is possible.

Developed for Johnson by the Victor Manufacturing and Gasket Co., the new gasket will withstand combustion gas temperatures up to 1600°F and is corrosion resistant. It is provided with a stainless steel overlapping flange to increase the burn-out resistance around the combustion opening.

RAILROADS RESEARCH ADHESIVES USE

A new epoxy resin glue has caught the interest of the nation's railroads. The American Association of Railroads has revealed that its research center in Chicago is using the new glue experimentally to bond steel rails to concrete crossties.

Trains will not roll over track held by glue alone. Rails will still be held fast by spikes and clamps as at present. The new glue, however, may one day replace the costly tie plates and other devices now used as buffers and ties.

Epoxy resin glue is also being used experimentally to join standard length of rail for use on light-traffic branch lines.

Another possible use of the glue is for bonding concrete bridge components to spread the load created by passing trains. The glue dries faster than conventional mortar, allowing trains to pass over a repaired bridge sooner than at present.

IS YOUR FASTENING PROBLEM ANSWERED HERE?

1. **Low first cost.** National has a plan designed for you. Where a capital investment is not desired, the National Lease Plan will make it possible for you to enjoy the savings of riveting with a minimum of expense. Where the nature of your product and the volume of riveting is sufficient, purchasing equipment is the most economical method. Let National give you advice based on over a quarter century of experience.
2. **Unskilled operators.** Riveting requires almost no training. You will be surprised how quickly your employees can gain money-saving speed.
3. **Inspection.** When you use National Tubular and Semi-Tubular rivets, the operator can tell at a glance that the job is correct. No other fastening method is so easily inspected at the point of fastening.
4. **Flexibility.** National equipment is easily and quickly set up for new jobs and new models. Obsolescence is practically eliminated because of the versatility of National Riveters and the low cost of re-tooling for new applications.
5. **Maintenance.** National Riveting equipment is noted for the ability to give outstanding service on the production line.
6. **Fastening quality.** National engineered fastenings can give you the qualities you need, *plus* exceptional manpower savings.
7. **Is your fastening job too small to automate with riveting?** Probably not. Over 90% of the riveting machines in use today are low cost, single floor or bench riveters. They are easily adapted to new jobs and new products. One machine often releases 3 or 4 employees for other work. Where conditions warrant, National multi-headed riveters are available.

Write National about your fastening problem now. Send product or blue print. You get prompt attention without obligation.

NATIONAL RIVET & MFG. CO.
211 Main St., Waupun, Wis.

NATIONAL RIVETS
TUBULAR, SPLIT, SOLID ALL METALS

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Courtesy Fawick Airflex Corporation

No more hand tightening!

...ROTOR W DRIVER

cuts assembly time 30%

JOB: Driving ¼"– 20 Phillips flat-head machine screws in brake segments. Formerly used electric screw driver. Screws had to be hand-tightened after running.

Changed to Rotor S-01 PRC air screw driver at 1600 rpm.

RESULTS: Screws now run to uniform tightness. Eliminates hand tightening. Savings of 30% in time pay for tool in 15 weeks. Cuts operator fatigue.

Ask for demonstration of this screwdriver and other Rotor air tools to find out how they can cut *your* costs.

Write for full-line Bulletin 53-C.

ROTOR AIR TOOLS: Assembly Tools • Drills • Small Wheel Grinders Straight Grinders • Vertical Grinders • Scalers • Chippers • Rammers Special Tools • Air Motors

ROTOR HIGH-CYCLE ELECTRIC TOOLS: Grinders • Polishers • Sanders

ROTOR TOOLS

The Rotor Tool Company · Cleveland, Ohio

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HOW CHEAP FASTENERS CAN SPIRAL ASSEMBLY COSTS

It's not the initial cost of fasteners that counts, but their in-place cost in the complete assembly that determines their true value. This truism is brought home in this report of the economic troubles that befell one company after its purchase of some bargain fasteners.

by **S. S. Kahn,** Vice President
Parker-Kalon, a Division of
General American Transportation Corp.

What I am going to relate to you is no fable. It is a compilation of a series of actual case histories. Some of you may have had similar experiences in your own operations, so the end results may be nothing new to you. However, we are going to explore the causes of these end results. This should prompt you to take a second look at your assembly problems, which, if corrected at the outset, could save your company money while turning out better products.

This is the true tale of woe that befell an appliance company when they tried to assemble vacuum cleaners with cheap fasteners. Of course, we won't mention the name of the company, but for the purpose of this article, we will refer to it as the Outer Space Appliance Company.

Joe Doaks, the company's newly-appointed fastener buyer, had just been analyzing prices from a number of vendors on No. 8—32 x ⅜ slotted oval hex washer head Type F tapping screws. While the yearly consumption of these fasteners would be approximately 1,000,000, the initial order was to be for 100,000.

The price range of the different vendors was between $3.00 and $4.00 per M, or a spread of 25%. Therefore, a million of the lowest price screws would represent a net savings of $1000 over the highest priced.

Now the Outer Space Appliance Company had their own plating facilities which were not overly taxed at this time. So the buyer decided that he would purchase the screws unfinished, and have them plated in the plant. Here was an opportunity to make further savings. A million of this type of screws weigh approximately 3000 pounds. And at 3¢ per pound saving, here was an additional saving of $60.00. For the million pieces a net saving of $1060.00 was evident.

The buyer feels that he has done a good day's work for his company. He makes a mental note of this for use at a time when it is opportune to make a bid for a salary increase. At this time he is blissfully unaware of the ultimate consequences of his action. Unfortunately he did not receive adequate training for his job before it was assigned to him. Previously, his work may have been in export sales. Since, his salary was approximately that of the former fastener buyer, he was transferred to his new position.

Along with the transfer went the hope and prayer of the personnel manager and other supervisors that the card index system of vendors, parts number list and incoming inspection procedures would keep him out of trouble. It was unfortunate that all concerned had forgotten a couple of lines from the "Essay on Criticism" by Alexander Pope, "A little learning is

continued

a dangerous thing; Drink deep, or touch not the Pierian spring." Hence the following tale of woe.

BARGAIN SCREWS OF APPARENT ASA QUALITY

Samples of the screws were received and examined. They appeared to be a quality product. The manufacturer guaranteed that the screws would conform to ASA specifications. A purchase order was issued, and in due time the first 100,000 screws were delivered.

Incoming inspection noted on their copy of the purchase order that the screws conformed to ASA specifications, and random samplings indicated that they were satisfactory.

Acting on plant process instructions, the screws were delivered to the plating department. They were given a standard commercial plating conforming to the operations procedure chart, then forwarded to the stock room.

These No. 8—32 x ⅜ thread-cutting screws are used at Outer Space Appliance for attaching a dished steel access plate to the vacuum cleaner motor housing. This housing is an aluminum die casting. The engagement material for the screws is about ¼" thick.

Four screws are used to hold the access plate in position. They are driven simultaneously by a hopper-fed automatic four-spindle screw driver. The oval hex washer head style was selected for the job because they could be driven economically. For field servicing the screws were slotted.

This particular model vacuum cleaner was assembled on a 12-station line. The basic housing, with the motor installed, was conveyorized for the attachment of the access plate at Station No. 1. The line started at 8 a.m. There are twelve operations supervised by a line foreman. Operator No. 1 was responsible for both placing the housing on the screw driver table and for maintaining the operation of the equipment. His wages were $1.65 per hour.

"Before long there was a pile of housings which had to be sent to salvage for re-work."

For the first hour there were no problems. The screws in the hopper were properly feeding; there were no jam-ups; and the access plate was firmly attached.

Just before the hopper was due to be replenished, operator No. 1 received from Stores a tote pan of new screws that had been plated the previous day by their Plating Department. The finish was dull and slightly speckled, but not enough in the operator's opinion to bring this matter to the attention of the line foreman. And though they were not as bright and shiny as the screws they had been previously using, several scoopfuls were dumped into the hopper.

ONLY THREE OF FOUR SCREWS WERE TIGHT

About 20 minutes later, the operation at Station No. 2 reported that three screws on the access plate were down tight but that the fourth screw was not seated home. It took some effort with a hand screw driver to seat this screw, thus slowing the work a bit. The operator of the screw driver machine was informed of the trouble. Since the master hopper on the machine fed four spindles, it was not always the same position in the housing that the screws were not driven all the way home. Such screws, that were projecting from the work, were random.

From this the operator concluded that the clutches on the four spindles were slipping. The machine was stopped and the clutches adjusted to get greater torque. Work was resumed.

Meanwhile, the housings at Stations No. 2 through No. 12 had progressed through the line, so the operators at these various stations ran out of work.

It took only 10 minutes to adjust the four clutches, but 10 minutes times 12 operators meant 120 minutes wasted. At $1.40 per hour this resulted in a loss of $2.80.

SCREWS WERE BREAKING OFF IN SECTION

The line continued operating satisfactorily for several hours until shortly after the hopper was refilled from another tote pan just delivered. No sooner than the new lot of screws were being fed to the four-spindle screwdriver than real trouble developed. One housing after another turned up with a screw here and there broken off in section.

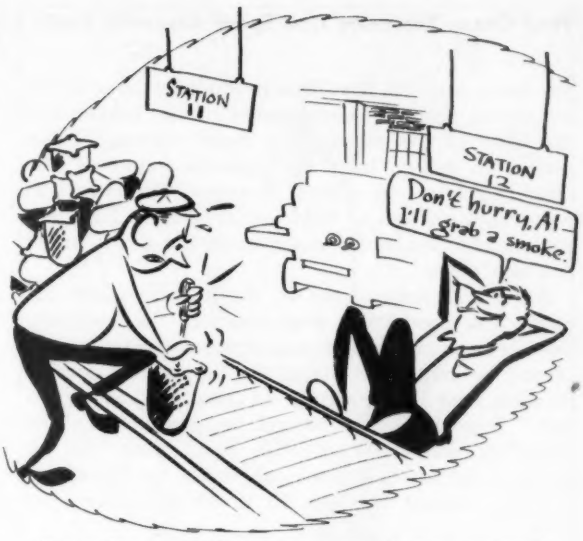
In accordance with instructions, all assemblies coming through the line with broken screws or defective accessories, regardless of nature, were taken off the line and sent to the salvage table for rework. Before long there were 10 housings that could not be further processed because in each case it was necessary to remove a broken screw.

The assembly line foreman assigned the operator at the No. 12 station to this job. The three good screws in the access plate had to be removed and then the broken screw laboriously backed out with

a pair of pliers. The three good screws were then replaced, plus another for the screw that failed. The 10 broken screws represented a cost of only 3½¢, slightly more than 1% of the original cost of 1000 screws. But it took seven minutes each to salvage the 12 housings, or a total cost of $2.25.

Meanwhile the operator at No. 11 station had been attempting to do his job as well as that of operator No. 12. Here and there he was forced to resort to many improvised shortcuts. Washers were left off the screws, fasteners on the casters were not seated home, sub-assemblies were not properly installed, etc. The operator was hopeful that these errors of omission would not be detected by the inspector, because it was the only way he could prevent a pile-up of housings.

Operators at stations No. 2 through No. 9 were not overly worked. Assembly efficiency was down about 15%. Normally the line produced 100 assemblies an hour, but due to the broken screws only 84 assemblies came through. Hourly wage costs for the line was $19.80. Therefore, since only 84 assemblies were made, the direct labor cost for assembling each machine was proportionately increased.



"It took some effort to seat the faulty screws."

PRODUCTION ENGINEER ENTERS THE ACT

The screw breakage continued to plague the line throughout the morning. The line foreman was not maintaining his schedule, so a hurried call brought the production engineer to station No. 1. The difficulty was explained to him, and he quickly spotted the reason for the failures. The operator of the screwdriving machine had increased tension on the clutches to such a point that the screws were failing in section. The reason so much torque was required to drive them home was that the screws were oversize between three and five thousands of an inch.

The production engineer was unable at the time to determine whether the oversize conditions was caused by improper manufacturing or by the company-applied plating. So to be on the safe side the hopper was cleaned out and a new lot of screws ordered from Stores. The line got back into operation just a few minutes before the noon shutdown. It took only 15 minutes of shutdown to identify the reason for the difficulty and take remedial action.

DOWNTIME TO RESET SCREWDRIVER CLUTCHES

The clutches on the screwdriver had to be reset to the original position, the screws in the hopper removed, and a new lot of screws secured from Stores. During this 15-minute period, the 12 line operators had another rest which resulted in a further loss of $5.40 in non-productive labor.

When operations were resumed after lunch, other problems became evident. Normally the sockets on the screwdrivers were replaced once or twice a week, with each socket driving between 5000 and 8000 screws before replacement. But with the new batch of screws, it was noticed that here and there some screws were not seated home. Fearful that there would be more broken screws, the line foreman decided to instruct operator No. 2 to drive the protruding screws home with a hand screwdriver. It took only a few seconds for this job, but it made the line go somewhat more slowly. Meanwhile the production engineer was again called back to investigate this new problem.

DOWNTIME TO REPLACE WORN SOCKETS

The screw diameters were checked and didn't appear to be oversize because they could be seated home without difficulty with a hand screwdriver. However, it was noted that the four sockets on the four-spindle machine were badly worn, and instructions were given to change them. About 10 minutes were required for this changeover.

What was causing this socket wear? The production engineer found that there was a considerable amount of play even when a new screw was inserted in a new socket. This resulted in rapid reaming of the sockets so that they could drive only about 1000 screws, instead of from 5000 to 8000 as only the day before.

These sockets cost 90¢ each, or $3.60 for the four. More important than the cost of the sockets was the fact that again 12 operators wrote up another 10 minutes each in non-productive time or $3.60 for lost labor.

FURTHER TROUBLE AT RANDOM

There was further trouble. Every once in a while an assembly came thorugh with random screws on the access plate not seated home. For the third time the production engineer was called on the job. Again the screws were checked. The thread diameter was o.k.; the hexes fitted the sockets fairly snugly. But he noticed that here and there the screws were improperly slotted. Instead of being slotted across the hex flats, the heads were random slotted. And on an estimated 1%, the screws were slotted across

continued

the corners of the hex. This produced a burr which interfered with the engagement of the socket and the head of the screw. The rapid turning of the socket in many instances quickly removed the offending burr. In others, however, the burr was just tough enough to hold up for a second the engagement of the tool. Consequently the screw would not seat home.

As it was impractical to check each screw for burrs, the production engineer told the assembly line foreman, who further instructed the operators, "Don't be concerned about the few screws coming through with burrs; simply let them go through the line." It took only a second or two to turn the offending screws down with hand tools. So all through the afternoon the schedules for the motor housings varied between 75 to 80 assemblies per hour.

ANOTHER CULPRIT—UNDERSIZED SCREWS

Occasionally, the operator at station No. 12 noticed that the housing plate was not seating flush with the housing. Sometimes the plate was separated from the housing by a few thousandths of an inch; at other times the condition was even worse. Since the housing was dished, the outside circumference was slightly warped but the four screws that held it in position would rectify this condition when seated home. This was pointed out to the line foreman from time to time but nothing was done to solve the problem. However, about 4 p.m., the line foreman was summoned by the inspector who pointed out that the plates on a number of the completed assemblies were not secure. A hand screwdriver was applied to the screws by the foreman who found it was impossible to tighten them securely. The screws would just spin in the holes. For the fourth time the production engineer was called in and the condition explained. This symptom of malfunctioning was identified as undersized screws.

"The 15-minute shutdown resulted in a further loss in non-productive labor"

"Permission for overtime was requested through production planning . . . Then the lid blew off!"

There were two ways possible to solve this problem. Either drill out the hole and use a larger size screw, or painstakingly search through a tote pan to find screws large enough, and then turn them in by hand.

There were 20 housings that had accumulated with the loose screws. Since they could not be held over for salvaging the following day, it was decided to keep two operators overtime. And permission for this overtime work was requested through the Production Planning Department.

PRODUCTION DOWN 20 PERCENT

At the same time the line foreman had completed his report for the day's assembly. The normal output of the line was scheduled for 800 assemblies per day, but because of the many difficulties that beset the line, only 640 units were products. This was a production loss of 20%.

This startling information, complete with explanatory notes, was conveyed to Production Planning. The lid blew off! Hurried phone calls to the Chief Inspector, Quality Control and Purchasing were made for the purpose of arranging an after-hours meeting to decide upon a course of action. I don't have to go into further detail as everyone is aware of what transpires at meetings of this nature.

Let us now recap what it cost Outer Space Appliance to switch to a new fastener source. First, let's start with the high quality screws that had been

used and which cost $4.00 per M. There were four screws in each assembly, and for 800 machines there were 3200 screws used at a cost of $12.80. Twelve operators were on the assembly line. At an average wage of $1.40 per hour times an eight-hour day, this comes to $134.40 for labor. Therefore, the total cost for assembling 800 machines with the higher quality screws is $147.20, or $0.184 per unit.

Now, using the cheaper quality fasteners—the ones that cost $3.00 per M, there were only 640 vacuum cleaners assembled. Four screws in each total 2560 screws. At $3.00 per M this comes to $7.68.

You will recall that for salvaging 20 of these machines, two operators were required on an overtime basis. Two operators at $1.40 per hour times 1½ overtime, times 2 hours comes to $8.40 for the overtime work.

Due to the undersize hex heads and the fact that some of the screws were burred, the wear on the four-spindle screwdriver sockets increased substantially. Therefore, four new sockets were required, which at 90¢ each totals $3.60.

The total assembly cost of the 640 machines comes to $154.08, or $0.240 per unit. This is broken down into $134.40 for the wages of 12 operators for an eight-hour day, $8.40 for overtime, $3.60 for extra screwdriver sockets, and $7.68 for 2560 fasteners.

So while it cost a little over 18¢ each to assemble 800 vacuum cleaners with the higher quality fasteners, it cost 24¢ each to assemble only 640 vacuum cleaners. Over-all, it cost $6.88 more to assemble 160 fewer units.

FASTENER COST UP 69 PERCENT

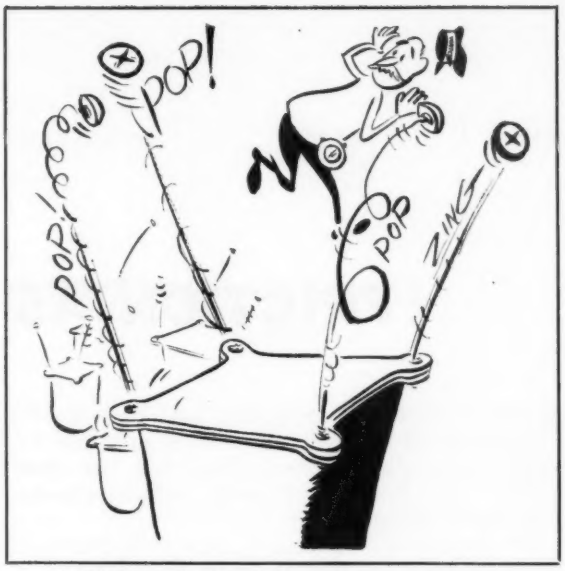
Let's carry this a step further. The good quality screws that Outer Space Appliance had been using cost $12.80 for 3200 pieces. The poorer quality screws would have cost $9.60 for 3200 pieces (though only 2560 were used). To this is added $12.00 because this represents the difference between the labor cost in assembling 800 machines and the labor cost plus the cost of four additional sockets used in assembling the 640 machines. Therefore, $9.60 for the screws, plus $12.00 for extra labor and extra sockets, is $21.60, or $6.75 per M screws. This is $2.75 per M more than when using the good screws—a 69% increase.

But this was not the end of the woes for the Outer Space Appliance Company.

The 640 completed vacuum cleaner bodies were delivered to the Packaging Department, inserted in the cartons along with accessories, instruction sheets, etc. The cartons were to be run through the package sealing machine as soon as a bank had been built up.

HYDROGEN EMBRITTLEMENT TAKES ITS TOLL

Unfortunately, a large percentage of these appliances never reached the market. Overnight, the insidious phenomena of hydrogen embrittlement started wreaking havoc. All through the night the heads of the cadmium plated screws that secured the access plate were popping off one after another.



"All through the night, screws were losing their heads one after another."

The plating department at the appliance company had failed to bake the screws. Consequently, they were permeated with free hydrogen ions. The screws, holding the plates under compression, were unable to absorb this extra load, and lost their heads.

PLACING THE RESPONSIBILITY

I don't know what happened to the hapless buyer who started this expensive tale of woe. While he had to bear the responsibility of his disastrous purchase, the responsibility was not his alone. Because he had not been educated to the proper responsibilities of his job, his guidance was limited to the information collected by his predecessor, and which was transcribed to the vendor purchasing records.

The moral from this is that management should make sure that key people in their organization are adequately trained to perform their job functions, and that authority be delegated with responsibility. The purchasing responsibility is a terrific one. But too frequently, value analysis is not considered a collateral arm of the purchasing function, but rather only a production measure.

Had the new fastener buyer for Outer Space Appliance been aware that he should have discussed his intended change in vendors with the production engineer, perhaps the observations just related would have had a happier ending.

Again, I want to point out that this was not a fable. While the company's name has been changed, these incidents actually occurred, but not necessarily in the sequence reported. Hundreds upon hundreds of such instances—some even more complex and expensive—have been noted. And while this article was concerned with only one type of fastener, it could just as well happen to other production parts. •

by **Harry Gerstung**
Manager, Technical Services
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FRICTION AS A FACTOR IN BOLT

Friction, both between mating male and female threads and between bolt heads or nuts and the washer face, is an extremely important, but often ignored, factor in the proper design and performance of threaded connections.

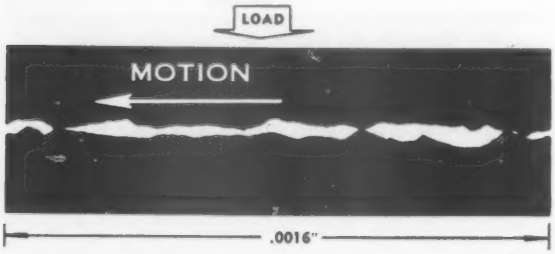


Fig. 1. Magnified profile of highly polished surfaces shows how rough an apparently smooth metal surface can be and the small areas of actual contact between them. The finish of the two surfaces represented here is 8 micro-inches R.M.S. Magnification is 2000 times.

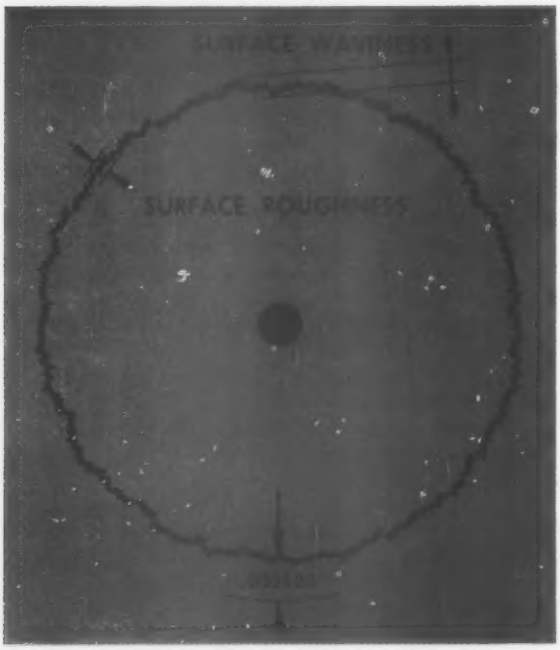


Fig. 2. Actual trace of the surface geometry of a highly finished roller bearing race. Note dimensional reference line, .000100 inch.

Besides being a primary cause of galling and seizing, friction also consumes an inordinate amount of the energy expended in tightening a bolt or nut. Being highly unpredictable, friction also prevents torque measurements from being reliable indications of bolt tension. Yet bolt tension is the true measure of tightness.

FRICTION AND TORQUE

Although torque is the most common method of determining bolt tension, it should be remembered that the relationship is merely relative. Actual bolt tension can be measured much more accurately in other ways. However, these other techniques are more difficult and complex, and are usually impractical from a production standpoint.

Skoog and Ward[1] have pointed out that, under normal shop conditions, about 90% of the energy used in tightening a nut is lost in overcoming friction. About 50% goes into friction between the nut and the washer face and 40% into sliding friction between the threads. Thus only 10% of the work in running a nut is usefully applied to the job at hand.

Obviously reducing friction can result in a greater portion of the energy being converted into bolt tension, thus providing desired tension at lower torque. In addition, reduced friction should make the relationship between torque readings and actual bolt tension much more consistent.

GALLING AND SEIZING

Galling and seizing of threaded connections are ancient problems which give every indication of growing rather than diminishing. The problem is more severe whenever mating threads are of similar metals. The increasing use of stainless steels, aluminum and such exotic metals as tungsten, titanium, molybdenum, Inconel X, etc., which have a greater tendency to gall, intensifies the problem. Increasing high temperature applications today also complicate the problem through expansion-squeeze and increased molecular activity at metal surfaces.

If the annual cost of repairing threaded connections damaged by galling and seizing were to be computed, it would be a staggering figure. One large oil refinery once estimated a yearly repair cost of $60,000 due to this single cause, not including time

This two-part article is concerned with an important factor too often ignored in the design of threaded connections

TENSION, GALLING, SEIZING — Part I

and labor lost removing stubbornly frozen fasteners. A metal forming plant once spent $5,000 to repair frozen threaded connections on an extrusion press.

Threaded connections gall and seize because the bearing pressure between mating threads is always extreme. These pressures often exceed the yield point of the metal at the small areas of actual contact. However, because little data has been available on the subject, engineers almost universally underestimate the bearing pressures involved.

Analysis of the surface geometry of machined metals illustrates how these pressures are attained. Figure 1 is a cross-section of two mating surfaces (finish 8 microinches, R.M.S.; magnification 2,000X). It is obvious that the actual contact area of these precision ground and lapped steel flats is only a small fraction of the apparent area of contact. A magnified trace of the surface geometry of a highly finished roller bearing race (Figure 2) further illustrates what appears to be a perfectly polished surface is actually made up of many minute asperities (peaks) of different but significant magnitudes.

Data compiled by Bowden and Tabor[2] (Figure 3) illustrates what takes place when such surfaces meet. The actual contact areas of two ground and lapped steel surfaces was measured under various loadings. Real pressures at the contact points of the bearing surfaces are always extreme and reach the compression yield strength of the steel even at very low loads.

If such extreme pressures exist at the high points of lightly loaded, precision ground and lapped flats, much higher pressures can be expected at the contact points of commercially machined threads.

A long and continuing series of tests on load distribution in threaded connections leads to the conclusion that at low loads mating contact occurs at only three points and that the number of contact points increases with load. Since these points of contact are not distributed symmetrically about the circumference of the threads, off center loading further increases the severity of contact pressures and frictional conditions.

THREAD LUBRICATION

Establishment of a permanent lubricating film between mating surfaces is, of course, the way to prevent galling, seizing and metal pickup between threads, and to reduce the amount of tightening energy lost to friction. However, when sliding members are at rest, liquid or semi-liquid lubricant films tend to leak out. Even assuming that some liquid is trapped and completely sealed in, its contribution to the reduction of load on the contacting metal peaks at rest is small considering the high compressibility of liquids as compared to metals—a fact which may seem strange to those brought up on the assumption of the "incompressibility of liquid."

Thus it takes a high starting force to break parts loose and considerable sliding velocity to reestablish and maintain these liquid films. Galling often occurs during these breakaway starts which happen after pauses during make-up as well as during bolt removal. This characteristic can also interfere with fine screw-thread adjustments on instruments and precision machine tools. Since sliding velocities high enough to support separation of surface peaks by hydrodynamic lubrication, are rarely, if ever, obtained on threaded fasteners it should be obvious that hydrodynamic lubrication can contribute little to reducing friction losses in threaded connections.

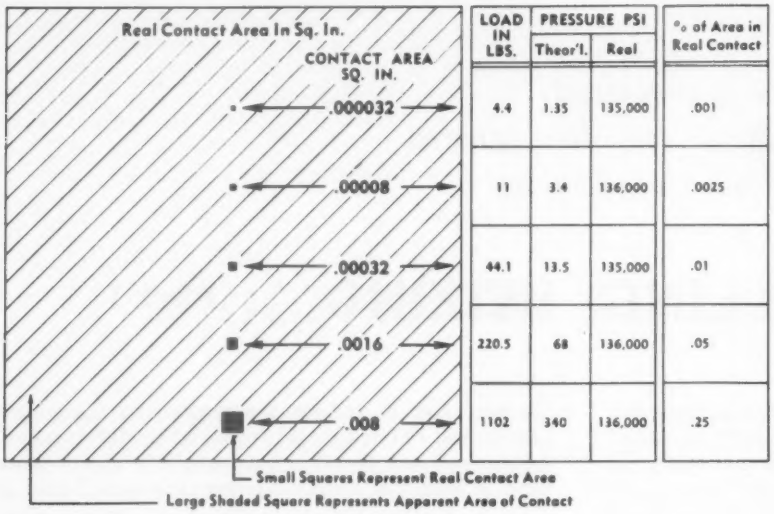
Elevated temperatures also contribute to increased galling and seizing. Temperatures of 300 F begin to destroy conventional lubricants and higher temperatures accelerate this destruction rapidly.

These considerations explain why relief from galling and seizing in threaded connections has been possible only with the use of solid lubricants. These include metal oxides, graphite and a few animal fats, but the newest addition to the solid lubricant field, molybdenum disulfide, has proved itself to be an excellent over-all thread lubricant. The refinery mentioned previously has reduced their $60,000 repair bill to a small fraction of that sum through the annual use of less than $100 worth of molybdenum disulfide lubricants.

The two basic characteristics of molybdenum disulfide lubricants which contribute to its excellence as a thread lubricant are its low coefficient of friction at extreme bearing pressures and its broad range of thermal stability.

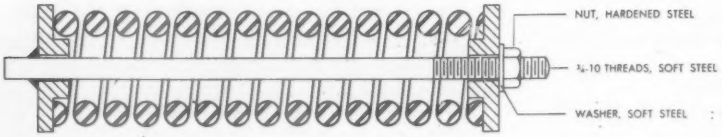
Molybdenum disulfide has, at extreme bearing pressures, the lowest coefficient of friction of any known solid. As measured in threaded connections, it ranges from .06 to .1 compared to 0.15 and 0.2 which are the coefficients of friction used as a basis in most bolt torque, tension and stress tables. Thus,

continued



LOAD IN LBS.	PRESSURE PSI		% of Area in Real Contact
	Theor'l.	Real	
4.4	1.35	135,000	.001
11	3.4	136,000	.0025
44.1	13.5	135,000	.01
220.5	68	136,000	.05
1102	340	136,000	.25

Fig. 3. Electrical measurements of the actual contact area of two ground and lapped steel flats at various loads provides the data presented here. At each loading, true bearing pressure based on actual contact area is very high, approaching the compression yield strength of the material. It is surprisingly uniform despite the load imposed.



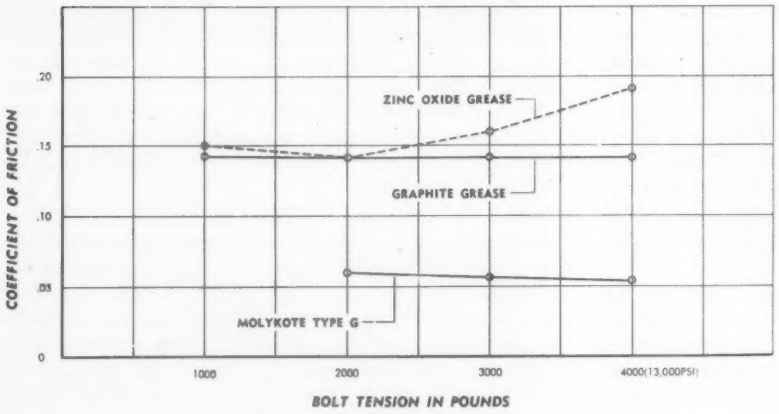


Fig. 4. Coefficient of friction for various solid lubricants calculated from data compiled with assembly shown above graph. A calibrated torque wrench was used and spring deflected to obtain bolt tension. Values for the molybdenum disulfide lubricant below 2000 lb tension were unobtainable because the wrench did not indicate the small torque values involved.

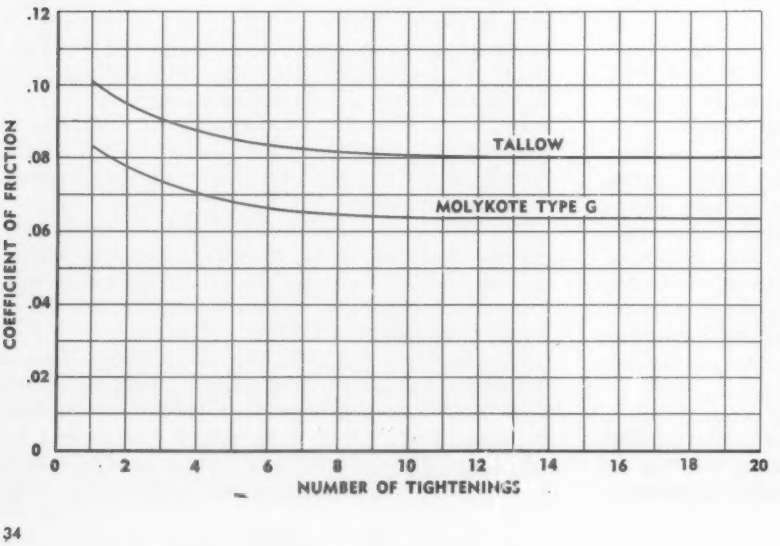


Fig. 5. Coefficient of friction calculated from test data compiled with the diesel cylinder head bolt assembly shown in Fig. 6 on the next page. Results are the average of 28 tests using 14 specimens for each lubricant. Variations from curve were 7% for the molybdenum disulfide lubricant, and, excluding those where galling took place, 8% for tallow. Graph shows that after one lubricant application, friction decreases to a steady value after nine tightenings.

its use allows a substantial reduction in make-up torque in many cases.

Figure 5 and 6 give friction test data for an MoS_2 concentrate of grease consistency compared to graphite grease, zinc oxide grease and tallow. A comparison of data shows close agreement between Figures 4 and 5 although bolt tension was considerably different, 4,000 pounds maximum (13,000 psi stress) for Figure 4 and approximately 40,000 pounds (105,000 psi stress) for Figure 5.

In order to obtain reliable data for threaded connections used on diesel cylinder heads, comparison tests between tallow and highly concentrated MoS_2 grease were made, using specimens shown in Figure 6. Results are shown in Figure 5[3].

The tallow was applied in liberal amounts on the threads and other friction surfaces of the nut. The MoS_2 was applied with a hard bristle brush to obtain a very thin and economical coating. A torque of 304 ft-lb was used to tighten the nuts; elastic extension was measured to determine bolt tension.

No galling or seizing tendencies could be noticed with MoS_2. Upon disassembly, the friction surfaces showed an almost indestructible mirror-like coating of the solid lubricant.

In contrast to this, tests with tallow resulted quite frequently in galling; after disassembly, friction surfaces had a dry appearance.

Molybdenum disulfide can be recommended as a lubricant on parts exposed to the atmosphere at all temperatures up to about 750° F. When used in threaded connections, however, applications as high as 1600° F are not unusual. This apparent inconsistency can be explained by the lack of air or oxygen existing in threaded connections.

Tests run by a valve manufacturer compared the torque required to loosen a number of 1½-in. x 7-in. stud-nut assemblies after 5,000 hours at 1,000° F. The assemblies had been lubricated thoroughly with various lubricants before tightening to a torque of 750 ft-lbs. The results of these tests, shown in Figure 7, indicate that the molybdenum disulfide lubricant was significantly superior to the other eight lubricants used.

In addition, the following properties of MoS_2 contribute to its importance as an all-purpose thread lubricant:

1. Great affinity for attachment to bearing surfaces (resists being wiped off or squeezed out).
2. Excellent chemical stability. It is attacked by only a few strong and concentrated acids.
3. Pure MoS_2 powder lubricants are not affected by atomic radiation.
4. Does not evaporate in a vacuum. It has operated successfully in vacuums up to 10^{-8} mm Hg.

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1. Skoog and Ward, "What is Proper Torque?", Assembly and Fastener Engineering, Feb. 1959.
2. Bowden and Tabor, "The Friction and Lubrication of Solids," Oxford University Press, London.
3. Excerpts from a paper in the December, 1954 issue of Schweize Verkehrs and Industries Revue (Swiss Review of Traffic and Industry). •

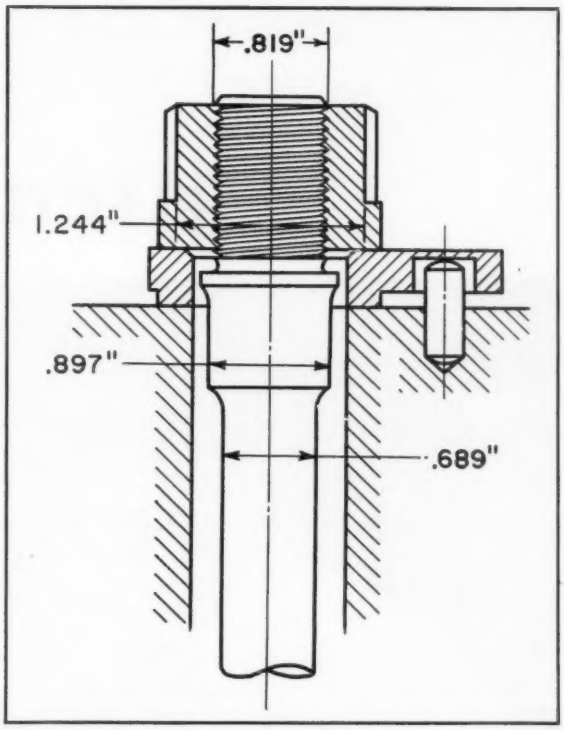
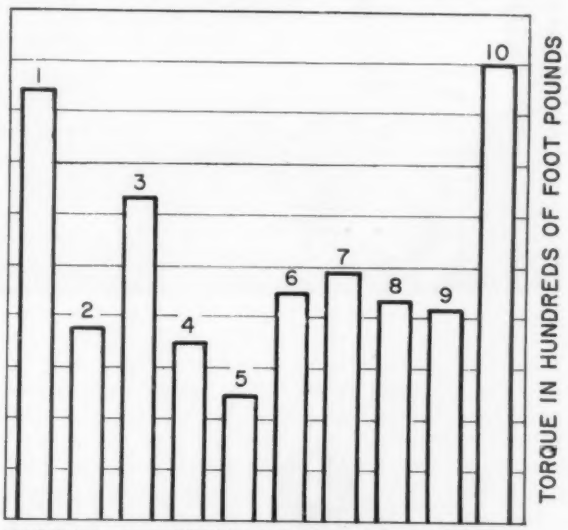


Fig. 6. This is the diesel cylinder head bolt assembly used to obtain the test data presented in Figure 5.

Fig. 7. Torque required to loosen 1¼ x 7" stud-nut assemblies after 5000 hrs at 1000°F. Assemblies were lubricated thoroughly with lubricants and tightened to 750 ft/lb torque. (Data courtesy Edward Valves, Inc.)



1. *No Lubricant*
2. *Graphite Powder*
3. *Colloidal Lead*
4. *Colloidal Copper*
5. *Molybdenum Disulfide*
6. *Aluminum Powder*
7. *Lime-Calcium Grease*
8. *Silicone Grease*
9. *Colloidal Zinc*
10. *Colloidal Graphite*

ELECTRON BEAM WELDING

by **Mars Hablanian**
Chief Development Engineer
NRC Equipment Corporation

When electron beam welding was in its formative stages, engineers saw it as a technique almost completely restricted to metals that could be joined in no other way.

There were sound reasons for this thinking: (a) some equipment, being primarily an outgrowth of the electron beam microscope, was extremely complex and very expensive, and there was some danger of x-ray radiation of personnel due to the high operating voltages employed; (b) with the simpler equipment the focal length of the beam could be adjusted only through a total distance of about ½

THOSE HARD-TO-JOIN METALS

. . . for those assemblies that must be evacuated and hermetically sealed . . . for dissimilar reactive and refractory alloys . . . for extremely thin sections . . . also for brazing, soldering, and heat treating

inch, which limited the applications to flat symmetrical assemblies; (c) the beam tended to be unstable due to the fact that electron acceleration took place between the source and the work, which functioned as the anode; and (d) welding had to be performed inside a vacuum chamber, a condition not conducive to production applications.

However, as experience was gained with the process, some of these objections proved to be pessimistic; others were minimized or eliminated by the development of production-type equipment. These new welders, one of which is illustrated here, generally are referred to as second generation types. They utilize magnetic focusing, and have beam accelerators built into the electron source. Additionally, their operating voltage is considerably lower than that of the precision laboratory models —on the order of 20,000 to 30,000 volts versus 100,000 to 150,000 volts. This is to minimize x-ray radiation and overcome the expense of lead shielding.

Several such welders are being used in production applications ranging from the welding of small fabricated sections of molybdenum, tungsten, tantalum, uranium, zirconium and columbium to assemblies such as gas turbine blades and precision bellows made of stainless steel and other less exotic metals. In addition, they have been used to weld a great many samples on an experimental basis. This experience, plus that previously obtained with earlier models, has provided a much broader concept of the capabilities and limitations of the electron beam process. In general, the present status can be summed up as follows:

1—Ideal applications for the process are for metals that must be welded in a vacuum or in an inert gas atmosphere; for products that must be sealed in a vacuum; or for metals whose melting points are so high as to create problems with arc welding electrodes.

Obviously, the reactive and refractory metals fit into the above category. In general, they must be welded in a controlled atmosphere to prevent the formation of oxide films that would prevent an integral weld and/or minimize adsorption of gases that might seriously affect the physical or mechanical properties both of the weld and of the base metal. To date, the most practical approach to welding of such materials has been the inert gas welding process. However, the impurities in highly purified inert gas greatly exceed those present at high vacuum.

Another principal field of application is for joining of assemblies that must be evacuated and hermetically sealed.

Since the joint is made in a high vacuum—on the order of 10^{-5} mm Hg—the assembly can be sealed at the same time it is welded. This eliminates the need for supplementary evacuation and sealing, and results in substantially lower production costs. Examples of such applications are hermetically sealed instruments, electronic tubes (for which the welder is used to evacuate and seal off the envelope, either glass or metal), and small precision bellows for automatic altitude adjustment of airborne control devices.

2—The process also is adaptable to the welding of thin gauge stock, joining of dissimilar metals, brazing of certain types of alloys and assemblies, soldering, and heat-treating.

One of the principal advantages of electron beam welders is that the operating temperature can be made extremely high. In fact, it is limited only by such considerations as cost and operating voltage.

The features that make the equipment potentially valuable for welding of thin gauge materials are its point source of heat, the high operating temperature of the beam, and the ease with which the input power can be adjusted. Exactly how these features compare with inert gas arc welding apparatus, and their effect on the extent of the applications are difficult to project. Some companies have been quite successful with the inert arc process; others have not. Success depends primarily on the materials to be joined, the design of the fixtures, the skill of the operator, and the sophistication of the control equip-

continued

Typical Machine Settings and Results For Various Sample Parts

Material and Welding Operation	Machine Setting Voltage	Current	Feed	Remarks
Butt weld Zircalloy ⅛-in. flat stock	20 kv	40 ma	6 to 8 ipm	Heavy weld bead
	20 kv	30 ma	6 to 8 ipm	Good weld. 2/1 width to depth ratio
Seam weld molybdenum liner 10.552-in. o.d., 6.750-in. high, 0.062 in. wall	15 kv	80 ma	6 to 8 ipm	Burned through
	15 kv	70 ma	6 to 8 ipm	Good weld. 1/1 width to depth ratio
Evacuate metal bellows and seal off 0.007-in. wall stainless steel tubing	15 kv	5 ma	6 ipm	Good weld, vacuum light seal
		10 ma	6 ipm	Good weld
		15 ma	6 ipm	Good weld
Butt weld ⅛-inch stainless steel plate	20 kv	60 ma	8 ipm	Not full weld—90% penetration
	20 kv	60 ma	7 ipm	Good weld—100% penetration
Butt weld 1/16-inch stainless steel plate	20 kv	30 ma	6 to 8 ipm	Good weld—100% penetration
Butt weld Type H-11 steel, 3/32-in. thick	20 kv	45 ma	6 to 8 ipm	Good weld—100% penetration
	21 kv	30 ma	6 to 8 ipm	75% penetration
	20 kv	35 ma	6 to 8 ipm	90% penetration
	20 kv	40 ma	6 to 8 ipm	Good weld—100% penetration
Butt welding columbium sheet				
—0.015 in. thick	15 kv	20 ma	6 to 8 ipm	Good weld—100% penetration
—0.030 in. thick	15 kv	40 ma	6 to 8 ipm	Good weld—100% penetration
—0.025 in. thick	15 kv	25 ma	6 to 8 ipm	Good weld—100% penetration
Butt weld tantalum sheet 0.013-in. thick	14.5 kv	20 ma	6 to 8 ipm	No weld
	14.5 kv	40 ma	6 to 8 ipm	100% penetration
Weld 1/2-in. o.d. stud to 0.125-in. tantalum sheet	20 kv	100 ma	6 to 8 ipm	Good weld. No distortion
Butt weld 3/32-in. thick vanadium-columbium alloy	22 kv	35 ma	Manual 8-in./min. feed	90% penetration. 1/1 width to depth ratio
	22 kv	45 ma	Manual 8-in./min. feed	90% penetration. 1/1 width to depth ratio
	24 kv	50 ma	Manual 8-in./min. feed	Over 100% penetration. 2/1 width to depth ratio
	24 kv	35 ma	Manual 6-in./min. feed	90% penetration. 1/1 width to depth ratio

ment. Undoubtedly, there is a place for electron beam welding in joining of extremely thin sections, if only because the size of the spot is small, and the amount of input power is about half or less than that required for inert arc welding. These factors combine to give a high depth to width ratio of weld and to reduce the amount of distortion that is experienced in certain assemblies. However, it is incorrect to say that electron beam welding will result in a distortion-free assembly. This is not always the case: it's a question of degree.

Since the beam can be defocused or the spot made larger in diameter than might be used for welding, it is also possible to use filler wire in making the joint—even to using the equipment for brazing, soldering or heat-treating of certain assemblies. In this respect, it is far more flexible than many other specialized welding processes.

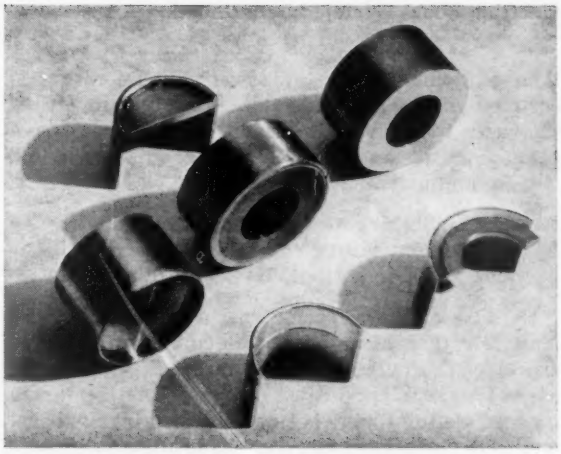
Another probable use will be for welding of dissimilar reactive and refractory alloys. In this case, the fact that the work is being done in high vacuum tends to reduce the formation of surface oxides and promote fusion. Therefore, any metals having a tendency to alloy metallurgically can readily be welded. The difficulty that arises is when the melting points of the alloys differ widely. This is analogous to an assembly employing similar metals of considerably different section thickness. One part is overheated, the other underheated, and the weld is unsound. On the other hand, if the melting points of the materials are not too far apart, proper fixturing, the use of cooling blocks to chill certain sections, and focusing of the beam on one section more than another will overcome these difficulties.

3—For general purpose work, welders with magnetic focusing are more desirable than those employing the work as the anode.

Initially, some welders incorporated a simple electron emission and focusing system consisting essentially of a shielded tungsten filament behind an electrode with an aperture. The high voltage potential was applied between this electron source and the work piece so that the work piece functioned as the anode. The principal disadvantage of this arrangement was that non-symmetrical sections or assemblies with vertical projections influenced the focus and caused arcing.

When the potential is applied between the cathode and an anode plate with the work piece at ground potential, the focal length of the spot can be changed six inches or more compared with the one-half to one inch previously possible. As a result, the equipment is very flexible and reliable.

Secondly, the aperture through which the beam passes is small enough to protect the electron source from pressure discharges that may occur if the weld material has a high gas content. It also overcomes another serious difficulty that has been encountered with equipment, namely, that arcing interrupts the process and causes uneveness in the weld. By utilizing electro-magnetic focusing, the designer can separate the electron source from the welding chamber, and, if desirable, pump it by a separate system. Thus, the welding chamber can be operated at a vacuum consistent with that required for best results, while the electron source is isolated from the main chamber and pumped at another vacuum level.



Electron beam welded parts. The cross-section pieces in foreground are aluminum; others are stainless steel.

4—Low voltage welders will supplant but not obsolete high voltage equipment.

As far as voltage is concerned, the new commercial welders are generally operated at a maximum power level of 20 to 30 kv at currents up to 200 milliamps, so that the equipment can produce up to 6 kw. There appears to be no technical reason why guns cannot be produced ranging in rating from say 1 kw or lower up to as high as 50 kw. As a matter of fact, a gun of the latter capacity has been in use now for over a year for electron beam melting; if adapted for welding it could probably handle plates of one to two inches in thickness of some of the high refractory metals.

By choice, these welders have been designed to operate at a voltage rating below which x-ray radiation becomes an operating hazard. In comparison, high voltage type electron beam equipment is designed to operate between 50,000 and 100,000 volts and must be carefully shielded to prevent radiation of operating personnel. The main advantage in using high voltages results from the ability of equipment to produce more concentrated beams and consequently higher heat fluxes. This helps to reduce the heat affected zone and produces, under certain conditions, remarkable fusion zone geometry. Here the depth to width ratio of the weld can be higher than 10:1. When such ratios are mandatory—and they are the reverse of those that are obtainable by conventional welding processes—there is no substitute for equipment with these high voltage ratings. But when depth to width ratios of 4:1 are satisfactory,

continued

then equipment with the lower voltage rating is certainly more than adequate. Actually, many of the welds that have been produced (see table) have been made at less than the rated voltage of low voltage equipment.

> 5—Establishment of the proper power level and current setting comes with experience, and while important, is easily arrived at.

Because of the refractory nature of many of the materials that have been welded, or an unusual aspect of the design, there is no such thing as yet as a standard application for the electron beam process. Settings have been established by empirical methods. Generally, this consists of a starting point utilizing about half the power of the inert arc process and then adjustment of voltage, current and welding speed to match joint requirements.

If a minimum width to depth ratio is required, the voltage is increased and the current decreased. If the melting point of the alloys is extremely high —as for example with tantalum—then a high current rating is also required. Experimental welds on two or three samples will establish the operating requirements for the welder. Typical machine settings and results for various sample parts are shown in the accompanying table. It is apparent that when poor penetration or a burned section resulted from too little or too much power, a slight adjustment produced good results.

> 6—Once the power level and current setting are established, production becomes a function of the design of the jigging and the experience of the operator.

Particularly is this true in the case of thin stock. Fixtures that will precisely locate a series of production parts so that the weld can be started and tracked automatically are the key to production use of electron beam equipment just as for any other type of welder. Multiple indexing fixtures, that would locate one assembly for welding then move it to the side and bring another assembly under the beam, may also be required to eliminate opening of the vacuum seal and pumping down the welder every time a new part is to be joined. This would enable a number of parts to be loaded and welded in sequence, and would speed up the work.

> 7—It is entirely feasible to provide a type of program control that automatically cycles the welder for repetitive jobs or even for certain types of job shop work.

This might be done either by driving the work table with a constant speed motor and programming the beam power, or maintaining the beam at a constant power level and varying the speed of the table.

Thus, the welder might be programmed so that more power would be used when the welder approached the center of the assembly than during the start because of the different heat transfer characteristics at the edge of the part. It would also avoid manual manipulation of the power level when welding complex or intricate sections.

On the other hand, users have reported that operators can develop sufficient skill on a specific assembly to operate the equipment satisfactorily. One reason is that the only variable, once the settings are established, is the welding current. This is the only thing that might be adjusted as the weld progresses. Other settings, such as voltage, focus current, etc., are used only for the establishment of the setting. They generally are not varied during operation.

> 8—The applications of electron beam welding are far broader than originally anticipated.

To date, equipment has been used not only for welding of the more exotic metals, such as tantalum and columbium which always have been difficult, but also for topping off thermocouples where precise control of the heat is required . . . for evacuating and sealing off instruments . . . for brazing, sintering and evaporation . . . for welding of nuclear fuel cells . . . for production of gas turbine blades and rocket nozzles, and many others

The bellows assembly is an excellent example of evacuation and sealing. Previously this was done in two operations. In order to obtain proper evacuation and assure adequate sealing, a small evacuating tube had to be formed on the body—later pinched off after the completed assembly was evacuated. Now these units are being produced in an electron beam welder. The tube has been eliminated. Sealing is done simply by providing a small hole in the assembly which then is closed simply by focusing the beam on the hole.

Another example was on turbine blade assemblies. These parts, which were approximately 0.350 inch thick, were joined at power settings of approximately 20,000 volts and 100 milliamperes. Full penetration was achieved.

Experimental welds on other sections consisting of Type 321 stainless, stainless steel and AISI 4140 plate, and a cobalt base alloy to AISI 4140 plate pointed up another feature of electron beam equipment. It is that a joint can be made inside a deep groove simply by focusing to a small diameter. By proper adjustment of the power and the speed, penetrations of up to 4:1 have been achieved at the bottom of deep narrow grooves of this type.

In short, electron beam equipment has in the past year proved itself in many ways. Not only has it been adapted for many more types of applications than originally envisioned, but the equipment has proved far less difficult to handle than originally had been anticipated. In order to adapt the equipment to individual parts, modifications can be made in the equipment in fixturing, work handling devices, and drives. It is in this area that work still remains to be done. As with other welding processes, it is more likely that this can be done more effectively by the user than by the equipment manufacturer. •

A hydraulically-operated assembly machine inserts two bearings and a seal into the ends of 635 tubes an hour at Whirlpool

BEARING, SEAL INSERTION IS FAST BUT PRECISE

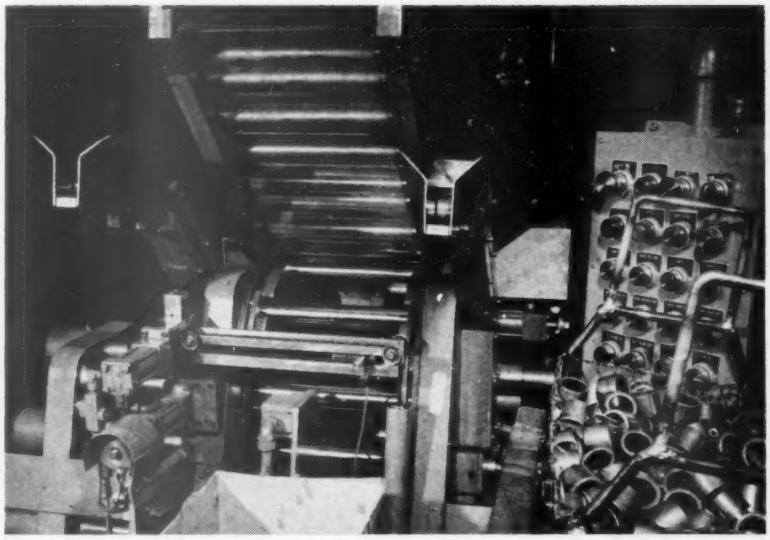


Fig. 1. Loading side of indexing drum machine that inserts a seal and two bearings into recessed ends of chrome-plated tubes. These tubes fits inside the hollow post of the rotary basket in automatic washers.

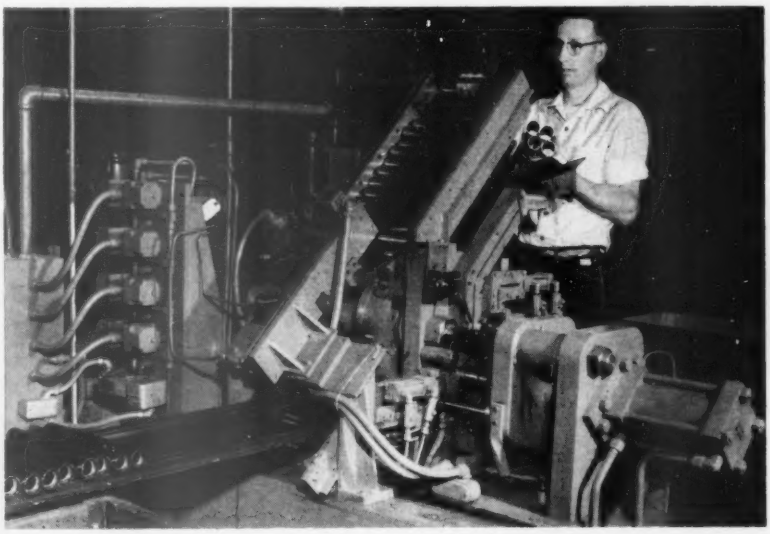


Fig. 2. Operator is loading tubes into inclined magazine of hydraulic machine which turns out 635 completed tube assemblies an hour.

by **Kenneth Anderson**
Tool Liaison Engineer
Whirlpool Corporation
Clyde, Ohio

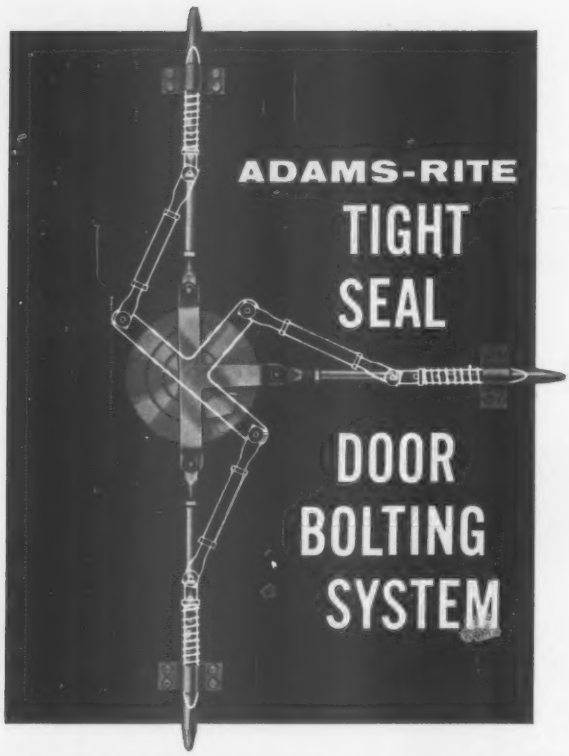
The insertion of bearings and seals in components for automatic equipment has to be a precision job if the complete assembly is to operate efficiently and reliably. This is especially important in home laundry equipment.

To this end we utilize an automatic machine for the precision insertion of two bearings and one seal in the center post tubes for automatic washers assembled at our Clyde Division. This operation is performed with the machine shown from the loading side in Figure 1, and from the output side in Figure 2.

The tubes, which are recess bored at each end to receive the porous bearings, are loaded by hand into an inclined magazine from which they feed, automatically, one-at-a-time into radial slots of an indexing drum or cage.

Bearings also are loaded by hand into inclined magazines at each side of the tube magazine. Below the latter is a fourth horizontal truck magazine running transversely. It is hand-loaded

continued



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with seals that are fed on edge to the left by a slide (Figure 1). Seals are advanced one at a time in front of an air plunger. When the plunger moves forward, a seal drops to loading position and is pushed transversely into the recess at one end of the tube which has been indexed by the drum to the corresponding work station, the first in the sequence.

Bearings feed from magazines by gravity to positions at opposite ends of the tube indexed to receive them. They are pushed into tube recesses axially at the second indexed work position by hydraulically-operated slides, moved to preset depth. At the third work station, a mandrel (moved by the hydraulic slide shown at right in Figure 2), carries a carbide ring burnishing tool that is forced through the bearing at that side. This tool does no cutting, but its burnishing action enlarges the bearing hole by about 0.0001", producing a high polish.

LIMIT SWITCHES CONTROL OPERATION

Bearings, seals and tubes must all close limit switches before the machine will sequence and operate. This eliminates any chance of producing partial or defective assemblies.

When indexed to the fourth station, each assembled tube is released onto an inclined tray (left in Figure 2), and rolls to a transfer station for removal to a tote box.

With this machine, one man loads two bearings and one seal into each of 635 tubes per hour, a fast rate for precise assembly. •

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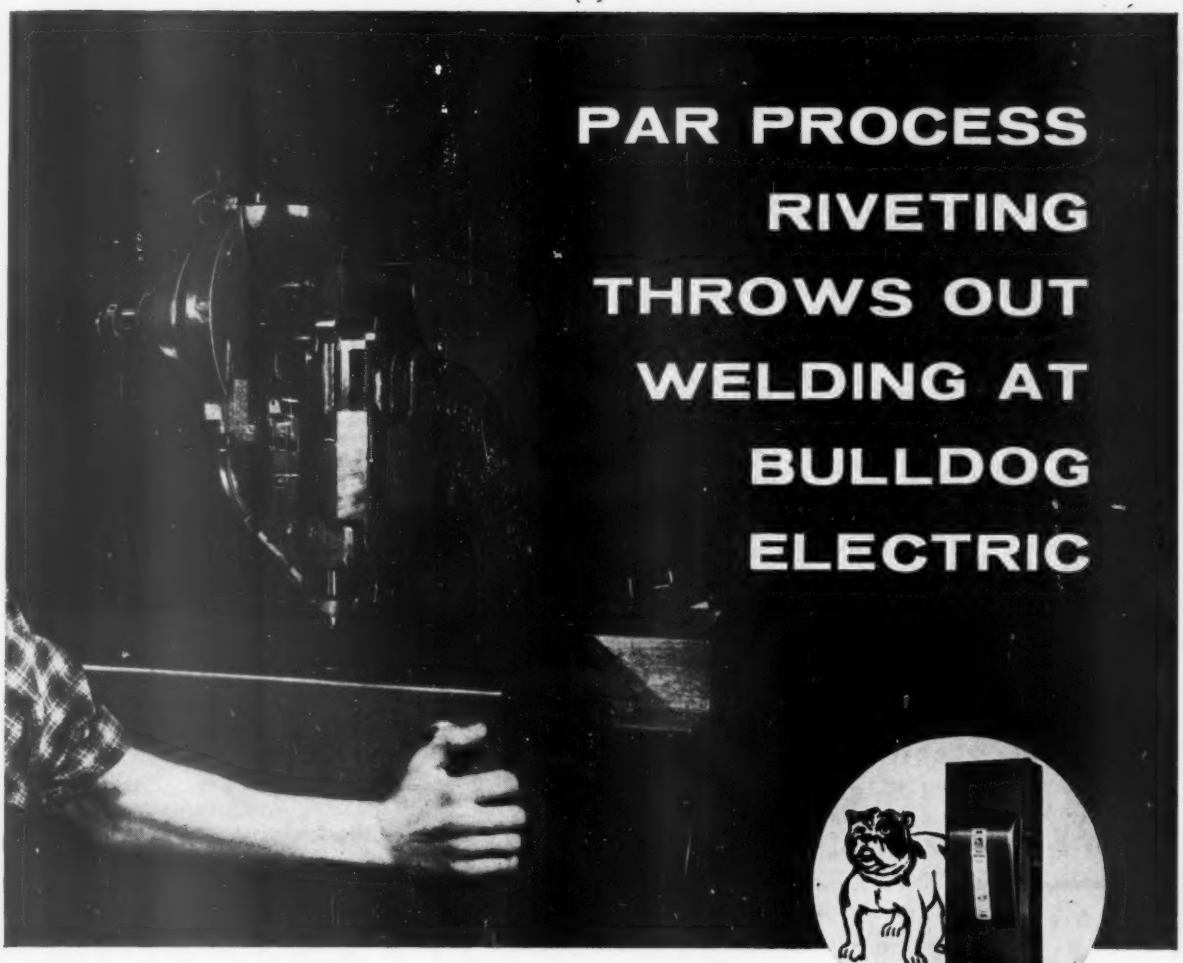

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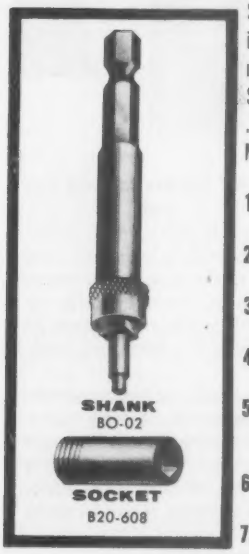

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A variety of ultrasonic micro-joining operations, including fluxless soldering and heatless welding, can now be accomplished with one basic unit, reports the Cavitron Corporation. Though developed especially for design, research and testing work, the micro-joining kit is also adaptable to production work.

Cavitron researchers report that micro-joining operations already performed with this table-sized kit include the following:

Welded gold wire as fine as .0004" diameter.

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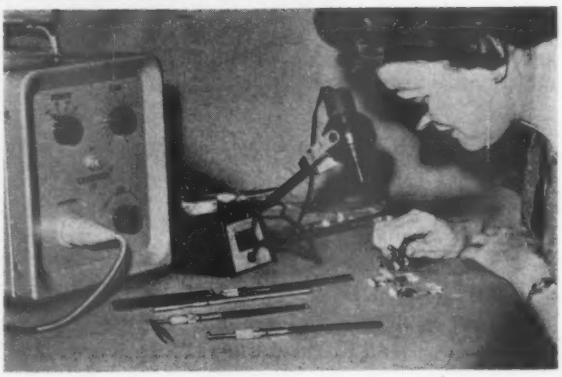
The basic kit includes attachments for tweezer welds, a ball-modification of the tweezer insert, a spot welding insert, and a vibrating table. A wheel head for seam welding is optional.

Micro-soldering without flux is possible with the use of a special heating transformer, soldering iron, and attachments for hot plate soldering. •

At left is close-up of operation shown below. Operator is using a ball modification of tweezer weld attachment of universal ultrasonic micro-joiner.



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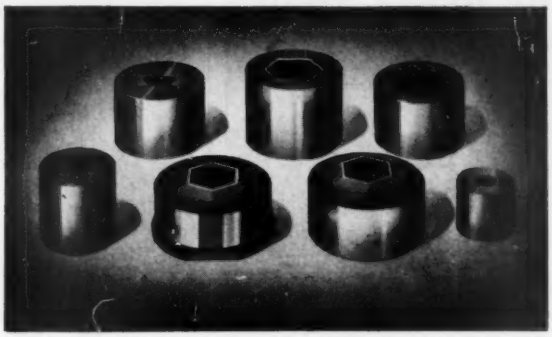

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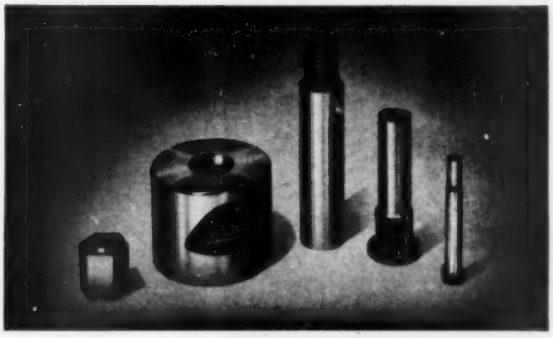

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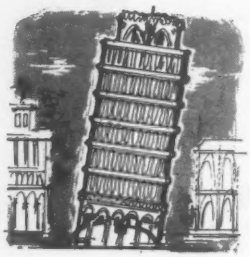


LEANING TOWER OF PISA

While at the Industrial Fastener symposium in Madison, Wis. last November, Vince Adamski of Pheoll Mfg. Co., stated that the authorities in charge have not contacted the right people concerning the ever increasing problem of the leaning Tower of Pisa. The tower is leaning more each year.

Architects and Civil Engineers would have them tear the tower down piece by piece and then rebuild it, straight and true.

Others have suggested that a large excavation on the opposite side of the tilt filled with concrete would cause a general settling, thereby bringing the tower back to a plumb condition.

The fastener engineer has a much simpler solution. To see how he would solve it, turn to page 67.

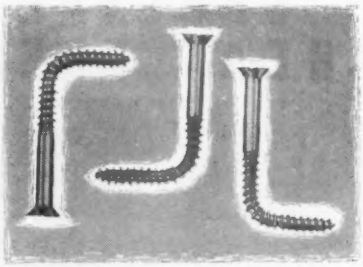
OH THE WONDER OF IT ALL

America: land of the brave, the free and the diversified manufacturer. This last characteristic was punched home by United Airlines' J. A. Herlihy. He pointed out that the flush toilets on the DC-8 jetliner are made by Monogram Precision Industries and the highly precise instrument used to record in-flight altitudes, air-speeds and accelerations by Waste King.

NEW PRODUCTS

The old Horatio Alger formula for success doesn't work in today's competitive market. Now you have to be two jumps ahead of your competitors.

To keep their company two jumps ahead, engineers at the Dumont Industrial Screw Corp. have designed a new right angle screw for hard-to-get-at places. If it doesn't fit your present needs, they would appreciate your designing something that calls for this type of fastener. They want to saturate the market before some competitor comes out with a left angle screw for hard-to-get-at places.



DID YOU KNOW . . .

. . . that two Seattle bars have installed time clocks to give customers proof of when they arrived and left . . . that table salt will soon be marketed in pink, green, coral and yellow . . . that The Drop Dead Co., a maker of chemical products, has applied for a new trade name—Promise . . . A Swiss cigaret case with a time lock allows heavy smokers to get at their smokes only at set intervals!

MATH OVER LIGHTLY

Assume that every tree has at least one leaf. If there are more trees than there are leaves on any one tree, then there exist at least two trees with the same number of leaves. Is the conclusion valid? (Answer on pg. 69)

—School Science & Mathematics

"American technological backwardness is getting pretty obvious. We haven't produced a new toothpaste in weeks."

REPRINTS AVAILABLE

- "Design and Application of Weld Fasteners" — July and August, 1959
- "Torque Considerations in Design"—January, 1960
- "Which Thread — Coarse or Fine?" — February, 1960
- "Designing for Silver Brazing with Preforms"—April, 1960
- "Resistance Welding Stainless Steel"—June, 1960
- "The Strength of Screw Threads"—June, 1960

If you need copies for your files, just drop us a note on your company letterhead.

Reader Service Department
ASSEMBLY & FASTENER ENGINEERING
Wheaton, Illinois

SPEED

CHOBERT BLIND RIVETS SPEED ANCHOR NUT ASSEMBLY ON NAA T39 SABRELINER ... With Chobert Blind Rivet System you can save money and time. One man, using the Chobert gun, can rivet four times as fast as two men using solid rivets on Anchor Nut Assembly. The Chobert Automatic Riveting Gun holds a mandrel of up to 92 rivets, and can be reloaded in 15 seconds. Start saving money and time... write now to Avdel, Inc., 210 South Victory Boulevard, Burbank, California.

AVDEL INC.

Use postpaid card. Circle No. 229

ELCO®

COLD-HEADED SPECIAL PARTS

FOR THE MODERN MISSILE AGE...

With so many things going at jet-power and rocket-speed, it is no wonder that designers and manufacturers are constantly looking for short-cuts, for cost-reducers, for longer life, for efficiency, for product improvement, for profit betterment. The adaptation and adoption of ELCO Cold-Headed Special parts can often gain many of these searched-for advantages. The cold-headed parts shown here are all recent outputs of ELCO engineering brains, planning know-how, and production experience. *If a particular part here interests you, mark it; then tear out this advertisement and send it to us.* We will tell you the whole story on that part, so you can decide if you want something like it. Send us prints or samples of parts you are now using—we would be pleased to quote. *Ask about the services of our process engineering department.*

ELCO [illegible] CORPORATION

1101 SAMUELS[illegible] ROAD [illegible] ORD, ILLINOIS

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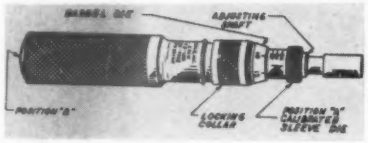
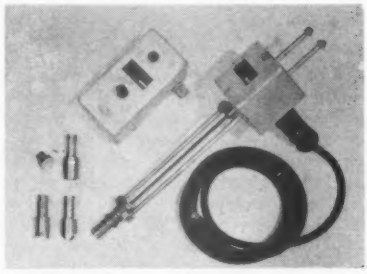
WHAT'S NEW IN EQUIPMENT

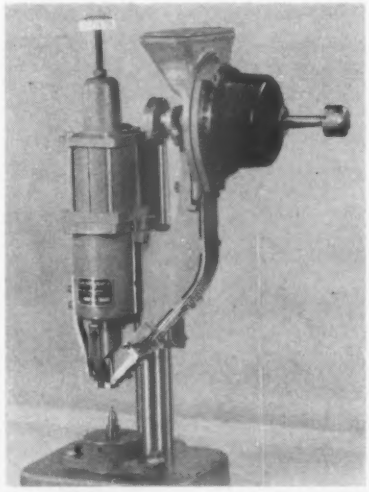
For information on any equipment listed here, use the postpaid card opposite page 66. Just circle the number on the card matching the number following the description. We'll do the rest.



(See Number 1)



(See Number 2)



(See Number 3)

SCREWDRIVER TORQUES IN EITHER DIRECTION

Built to meet all the requirements of MIL-H-26497 specifications, a torque screwdriver torques in either a right-hand or left-hand direction.

Two sizes are available, one with 4 to 100 inch ounces and a ¼" hex adapter; the other applies 2 to 30 inch lbs. It also has a ¼" adapter. Both are micrometer adjustable.

R. P. Gallien and Son, 220 W. Fifth St., Los Angeles 13, Calif.

Use postpaid card. Circle No. 1

WELD GUN MAKES ITS OWN RIVETS

A welding gun that operates without flash, heat or metal warping uses ordinary 14" low cost welding rods in sizes ranging from 1/32" to 5/32" diameter. It is designed to permit the distortion-free bonding of similar or dissimilar metals in any combination, from 30 gauge to heavy plate. It is in effect a "silent riveter" that makes its own rivets.

Shock-proof, and permitting continuous rod feed, it operates on either ac or dc current, and no special transformers or voltage adapters are required.

Rod feed utilizes a fused ceramic insulation guide, and features an all-new, built-in amperage surge control coil.

NoArc Equipment Co., 321 Academy St., Newark, N.J.

Use postpaid card. Circle No. 2

HIGH SPEED HOPPER FED TUBULAR RIVETER

An all electric bench type, hopper fed riveter is specially designed for automatic feeding and setting of tubular rivets and other small fasteners up to ⅛" diameter. Typical applications include work on car radio chassis, small speakers, photographic equipment, instruments, toys, switches, etc.

It offers automatic feeding and setting up to 60 per minute.

The complete unit, including stand, weighs less than 100 pounds, and has a 4" throat, 1⅛" stroke, a maximum shut height of 7", and can be mounted on a 2' x 3' bench.

Black and Webster, Inc., 570 Pleasant St., Watertown 72, Mass.

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ULTRASONIC WELDER JOINS SEMICONDUCTOR MATERIAL

Using high frequency vibrations, to weld without heat or without materially deforming the metal, gold plated semiconductor material and gold leads are welded by a 10 watt ultrasonic welder.

The welder can spot weld foil in thicknesses ranging from .00025 to .002", and is also useful in joining polyester film materials.

Accessories include a micro-second timer, and binocular microscope.

Vibro-Ceramics Sales, Gulton Industries, Inc., 212 Durham Ave., Metuchen, New Jersey.

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THERMO-CONTROLLED GLUE MELTING TANKS

Constant agitation and uniform temperature maintain the prescribed consistency of glue for dispensing in electrically heated glue melting tanks.

Seven standard sizes of all-purpose melting tanks are available for preparation and storage of animal or flexible glue, gums, plastic adhesives, etc.

As a storage reservoir, these tanks contain accurate variable dial thermostats which closely control wall and bottom temperatures. Heat loss is negligible with the glass blanket or expended mica thermal insulation. Standard voltages are 115 to 550, single or three phase, 50 or 60 cycle.

Sta-Warm Electric Co., North Chestnut St., Ravenna, Ohio.

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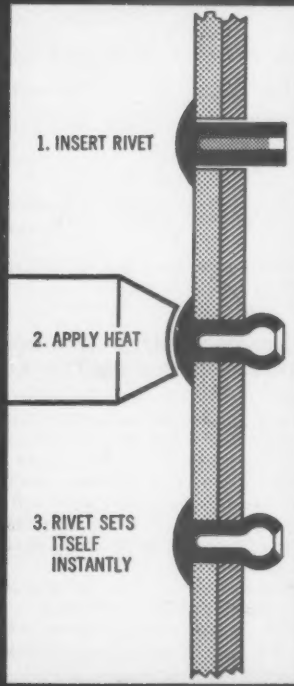
UNIT MAKES SPRINGS, SMALL PARTS IN ONE CYCLE

Up to the present time, the fabrication of springs required two machines performing two separate functions. The Spring Generator produces the entire

NEW DU PONT EXPANSION BLIND RIVETS

...safe, simple, economical



- One unskilled operator can set up to 25 per minute... in blind applications.
- Fasten metal, wood, rubber, fibreboard, plastic, tubing, etc.
- No expensive tooling—all you need is a soldering iron.
- Safe, positive sealing; shank expands along full length for wider grip range.
- No finishing operation required.
- Simple, one-piece design.
- Brazier or countersunk head.
- Available in brass, chrome plated brass, aluminum, stainless steel.
- Tamper Proof

Send for details

THE BOWMAN PRODUCTS CO.

Industrial Division

850 East 72nd St. • Cleveland 3, Ohio

Exclusive distributors:

DU PONT Industrial Blind Expansion Rivets

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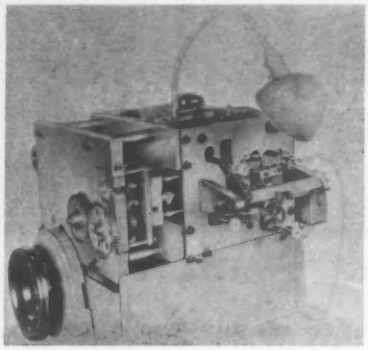
spring with formed loops in one cycle. It can also be used to produce clips, clamps, coils and related wire products.



The machine can make different end loops, including extended hooks. The load tolerance is decreased to 5%, plus or minus, and over-all better quality control is achieved. The compact, high production unit will accept wire from .008" to .034" in diameter, and has a variable production rate of 720 to 6400 pieces per hour.

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.

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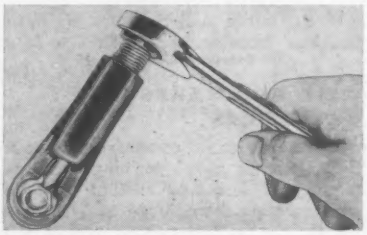
ANGLED NUT BUSTER FOR HARD TO GET AT PLACES



A nut buster splits and removes rusty or frozen nuts without damage to threads or bolts, in hard to get at places such as close assemblies and countersinks.

The nut buster primarily consists of a cast steel hex shaft, 3½" long, flattened on one end to provide a round opening that fits over the rusty nut. Running lengthwise through the shaft is a chrome moly steel bolt, with a cutter on one end, and a hex head and threads for driving the cutter into the side of the rusty nut.

The tool steel cutter is capable of splitting over 100 bolts before resharpening. The off-set nut buster is angled for easier wrench application.

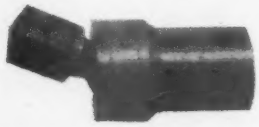
Burroughs Tool and Equipment Corp., 2429 N. Burdick St., Kalamazoo, Mich.

Use postpaid card. Circle No. 7

UNIVERSAL SOCKET HAS ALL BALL-BEARING JOINT

The male (main ball) of an all ball-bearing wrench is completely seated in the precision ball socket, giving solid support for maximum pressure regardless of angle or position.

The universal sockets are made in hexagon and double hexagon openings, and the adapters have a square male and female end, making them adaptable to power socket wrenches.



All opening sizes and drive ends are made to strict tolerances in conformity with military and industrial specifications.

Hague Manufacturing Co., 1643 Massillon Rd., Akron 12, Ohio.

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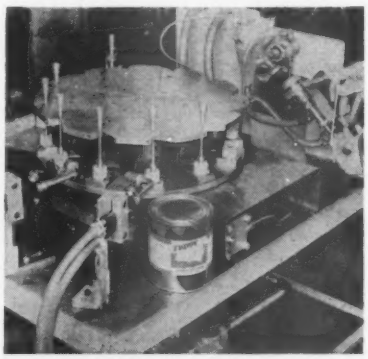
LOW-COST SOLDERING WITH INDEXING MACHINE



A simple low-cost indexing machine has been designed to semi-automate soldering at a substantial increase in production. In the use of the new machine on one job, labor cost reduction alone amounted to 8¼ cents per piece. Key to the operation of the machine is rapid metering of the paste (solder and flux combined) to the part.

Fusion Engineering Co., 17921 Roseland Ave., Cleveland 12, Ohio.

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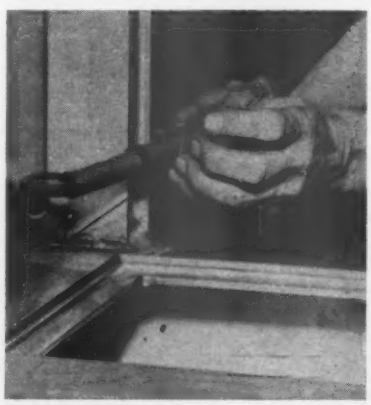
FLEXIBLE BODY WELDING TORCH READILY ADJUSTABLE



The development of a controlled angle torch, for use in tungsten inert gas arc welding, features a flexible body that

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Rockford HOME WORKSHOP

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ROCKFORD SCREW PRODUCTS CO.
Rockford, Illinois

HOME WORKSHOP PROJECT of the MONTH

ORIGINAL DESIGNS

JANUARY 1961

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HOME WORKSHOP
PROJECT of the
MONTH

Hobby-neering
with
"ROCKFORD"
Screw Products

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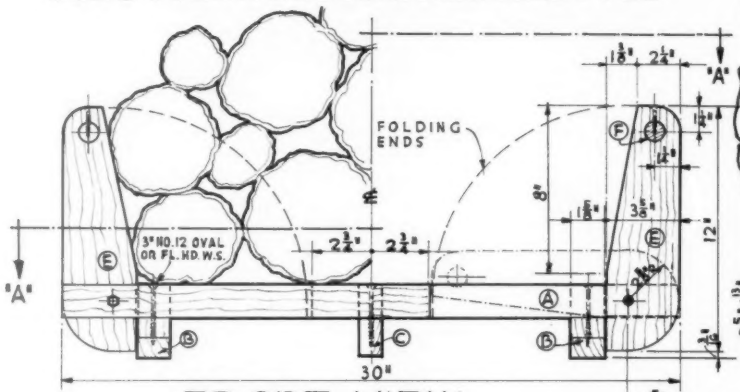
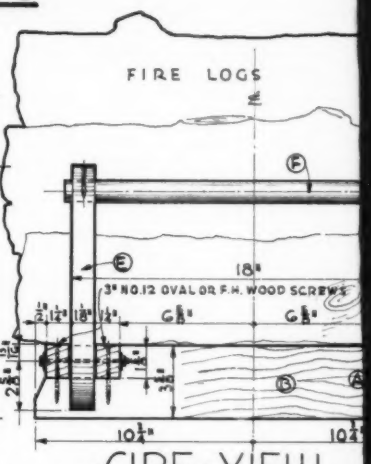
ROCKFORD SCREW PRODUCTS CO.
Rockford, Illinois

Folding..Fire-Log..Rack

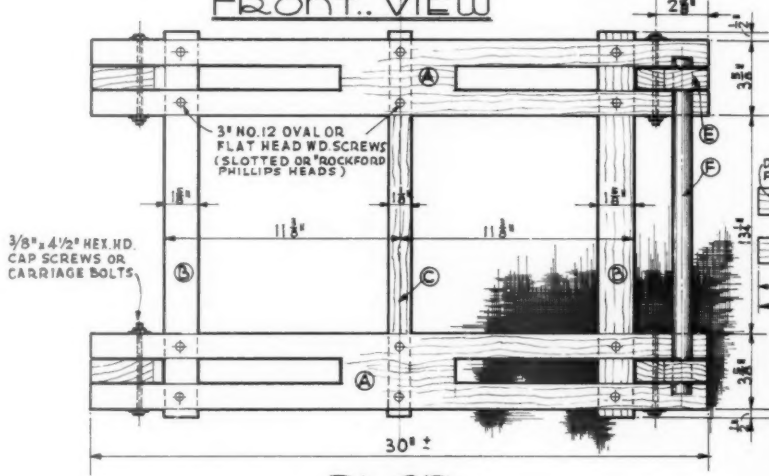
"RUSTIC"..WESTERN-RANCH..STYLE



FRONT.. VIEW

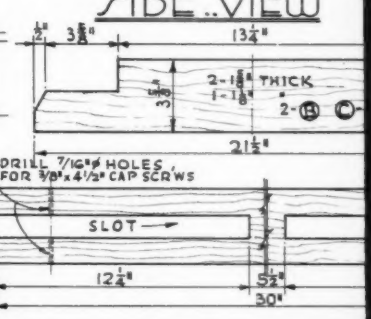


SIDE..VIEW



PLAN

ON SECTION LINE "A-A"



BILL..OF..MATERIA	
2 PCS. 1 5/8" x 3 5/8" x 30" Ⓐ	"ROCKFORD" S
2 " 1 5/8" x 3 5/8" x 21 1/2" Ⓑ	1 DOZ. 3" NO.12 O
1 PC. 1 1/8" x 3 5/8" x 21 1/2" Ⓒ	4 - 1 1/2" " G
4 PCS. 1 1/8" x 3 5/8" x 12" Ⓔ	4 - 3/8" x 4 1/2 (CARRIA
2 " 1" ø x 19" Ⓕ	4 - 3/8" HEX. WASHER
REDWOOD FINISHED NATURAL ALL EDGES SANDED WORN EFFECT	

NEXT MONTH:
COMPANION PIECE ?? IDEAL FOR RA

HAGER DESIGN STUDIO 6-6-84

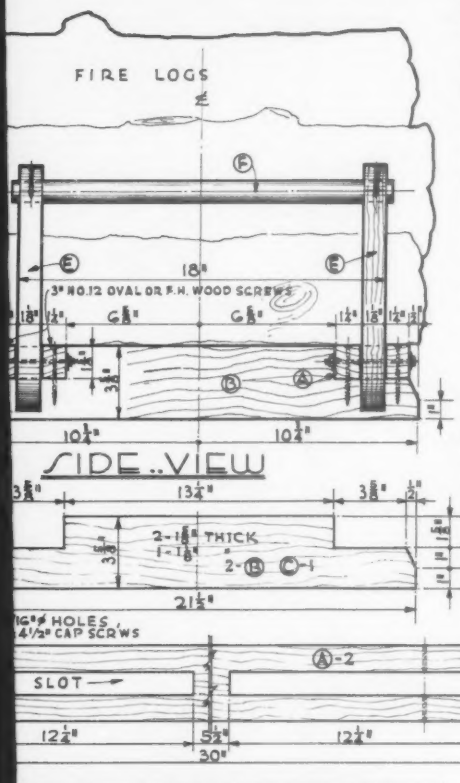
Hi Podners:

Reckon you fellers with New Ranch Houses will think this project right smart

- LET'S GO WESTERN FOR THOSE WHO LOVE AN OPEN FIRE AND FIND IT A PROBLEM TO STORE A NIGHTS SUPPLY OF FIRE-LOGS HANDILY.
- THE RUGGEDNESS OF THIS RACK IS IN KEEPING WITH THE SIMPLICITY AND CHARM OF WESTERN TRADITIONS.
- THE FOLDING FEATURE WILL ALLOW COMPACT STORAGE OF RACK OUT OF SEASON, ALTHO I BELIEVE IT WILL REMAIN AS A PERMANENT FIXTURE UNLESS USED OUTDOOR.
- REDWOOD IS SPECIFIED, ALTHO OTHER TYPE LUMBER MAY BE USED.
- FOR ADDED CHARM EDGES CAN BE IRREGULARLY SANDED ROUND. FINISH NATURAL BY APPLYING THREE COATS OF PASTE WAX OR THREE COATS OF VARNISH, RUBBING DOWN LAST COAT WITH FINE STEEL WOOL.
- SIZE SHOWN ON DRAWING IS IDEAL FOR 24" LONG LOGS. CHANGES CAN BE MADE IN DIMENSIONS TO SUIT YOUR NEEDS.
- NEXT MONTH'S PROJECT IS A COMPANION PIECE TO THIS ONE

"adios" till then.

HERM.



ALL..OF..MATERIALS.

1⅝" x 3⅜" x 30" Ⓐ	"ROCKFORD" SCREWS & BOLTS
1⅝" x 3⅜" x 21½" Ⓑ	1 DOZ. 3" NO.12 OVAL OR F.H. W.S.
1⅛" x 3⅜" x 21½" Ⓒ	4 - 1½" " G " " "
1⅛" x 3⅜" x 12" Ⓔ	4 - ⅜" x 4½" CAP SCREWS OR (CARRIAGE BOLTS)
1" ø x 19" Ⓕ	4 - ⅜" HEX. OR ACORN NUTS & WASHERS

RD. FINISHED NATURAL, ES SANDED MOAT EFFECT

MONTH:
ANION PIECE ?? IDEAL FOR RANCH TYPE HOMES.

Hobby-neering®

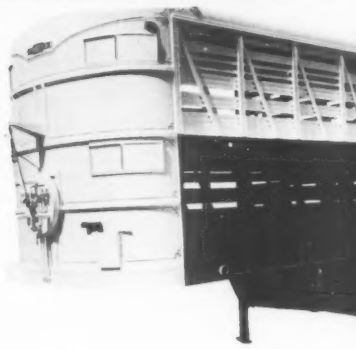
SERIES.. NO.10

PROJECT 10

Designed by A. JAGER OF ROCKFORD

USE FOR COMMERCIAL PURPOSES IS STRICTLY FORBIDDEN

★ HERE THERE AND EVERYWHERE wit



Manufactured by:
WILSON TRAILER COMPANY
2400 Leech Avenue
SIOUX CITY 6, IOWA

The New PARK LANE 52' x 10' w
by: RICHARDSON HOMES COR
ELKHART, INDIANA

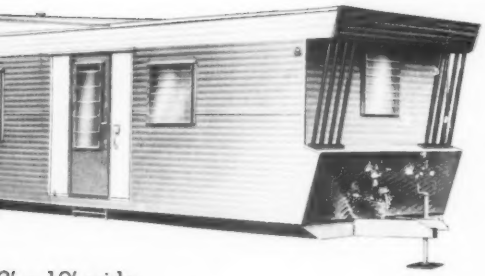
"ROCKFORD" THREADED FASTE
BY MANY OF THE LEADING MA
MOBILE & TRANSPORTATION V

WHERE with "ROCKFORD" Screws and Bolts ★

Model FSTLDC

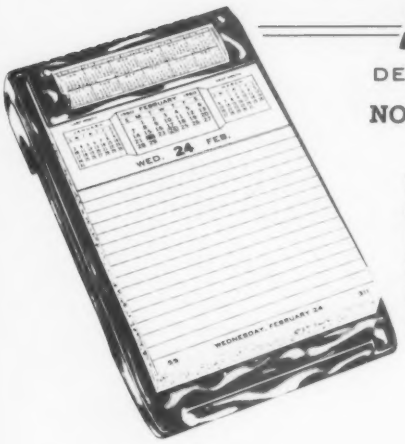
Drop center
Livestock Trailer

MPANY



2′ x 10′ wide
MES CORPORATION

ED FASTENERS ARE USED
DING MANUFACTURERS OF
ATION VEHICLES.



Success

DESK CALENDARS

NO. 85 CALENDAR

By:
COLUMBIAN ART WORKS
INCORPORATED
2300 W. Cornell Street
MILWAUKEE 9, WIS.
CALENDAR MANUFACTURERS

Extreme Rugged Caster
Capable of loads up to
7500 lbs.

Heavy Duty Dual 16"
Pneumatic Shock-Absorbing
Caster.

Manufactured by:
AEROL CO., INC.
3235 San Fernando Road
LOS ANGELES 65, CALIF.

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TELETYPE
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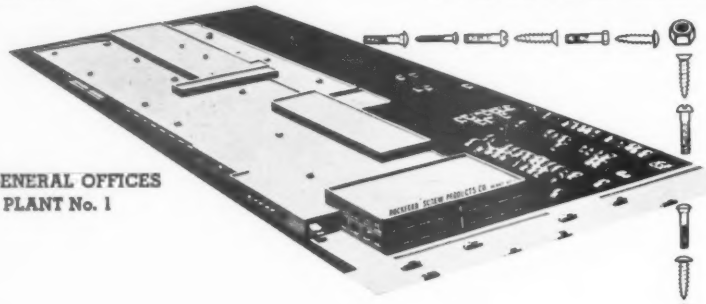
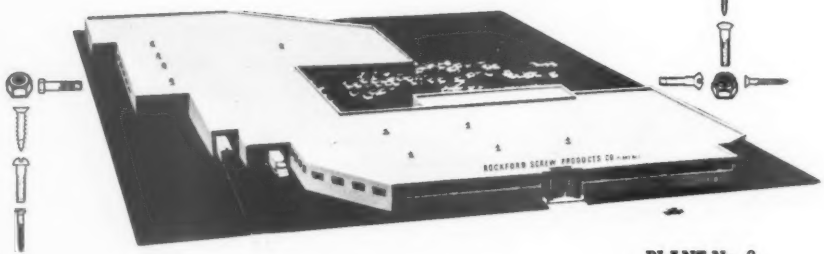
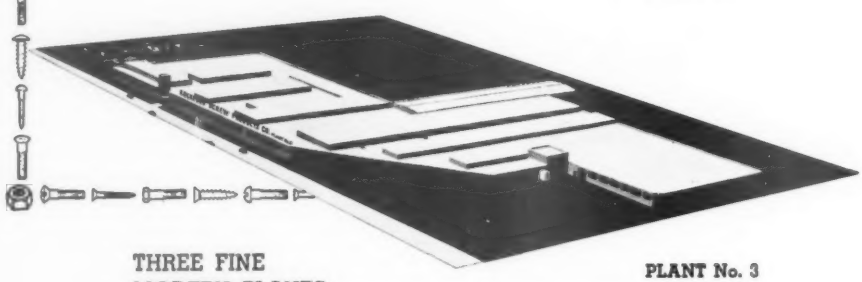
"ROCKFORD"®
Screw Products Co.
2501 NINTH STREET - ROCKFORD, ILL.



GENERAL OFFICES
& PLANT No. 1



PLANT No. 2



PLANT No. 3

THREE FINE
MODERN PLANTS
PRODUCING "ROCKFORD" QUALITY CONTROLLED
THREADED FASTENERS FOR AMERICAN INDUSTRIES.

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ROCKFORD SCREW PRODUCTS CO.
Rockford, Illinois

"ROCKFORD"®
HOME WORKSHOP
PROJECT of the
MONTH

a revolutionary
new wire stripper
from

UTICA

Strip fast and clean! Eliminate nicking! Reduce insulation marking to an absolute minimum! Handle any wire size from #12 to #26 (Teflon as well as most other solid or stranded wire insulations). And do it all with Stripwright®... Utica's revolutionary new wire stripper. There's never been anything like it. This versatile, lightweight, pistol-grip tool is engineered for efficiency and ease of handling in limited access areas as well as for open production lines. Stripwright is designed to the same high standards of quality as all other Utica tools. Hundreds are now in service. Write for complete information.

Adjustable stop permits stripping of any length up to 7/8" per stroke.
Cam action dial adjusts strip diameter to the finest variation.
Plastic handles . . . strong, light, comfortable.
STRIPWRIGHT TM
SW-1 USA
PATS PEND

Slim nose design makes it possible to reach into the most closely confined areas, strip fast and sure.

UTICA DROP FORGE & TOOL DIVISION,
KELSEY-HAYES COMPANY, UTICA 4, N.Y.

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General Vibrex
MULTI-FUNCTION
FASTENERS

The versatile half-turn fasteners combine the advantages of a quick acting panel lock with those of an elastic shock isolator.

- *Damp noise*
- *Eliminate rattles*
- *Simplify assembly*
- *Correct Alignment*
- *Absorb shock, vibration*

The Vibrex Fastener locks by means of an expanding, waterproof and dustproof sleeve of especially compounded rubber. This forms an elastic suspension which actually floats the panel-base assembly in live resilient rubber.

Call your Avnet Applications Engineer

For dependable service

and immediate delivery*

AVNET

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AVNET•5077 Rodeo Rd., Los Angeles 16, Cal.-UP 0-6141
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AVNET•2728 N. Mannheim Rd., Melrose Park, Ill.-GL 5-8160
AVNET•1262 N. Lawrence Sta. Rd., Sunnyvale, Cal. -RE 6-0300

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can be readily hand-adjusted to any angle, as well as extended to reach into difficult recesses.

The torch makes possible the substitution of one torch for many torches of varying head angles, styles and sizes, and allows the operator to set the torch angle to fit his hand and style.

Falstrom Co., 147 Falstrom Ct., Passaic, N.J.

Use postpaid card. Circle No. 10

PORTABLE TOOL UPSETS TWO RIVETS AT ONE TIME

For the installation of anchor nut plates, and similar fastener receptacles, a pneumatic riveter will upset two 1/8" rivets simultaneously eliminating "out-of-alignment" conditions.

Full and consistent power at all stages of the power ram's travel makes the model W650 riveter ideal for riveting, dimpling, terminal lugging, light joggling and many other operations otherwise performed on stationary equipment due to power limitations of other portable squeezers.

Wedgelock Corporation, Fastener Division, 11323 Hartland St., North Hollywood, California.

Use postpaid card. Circle No. 11

MAGNIFIER AIDS ASSEMBLY OF PRECISION INSTRUMENTS

Illuminated magnifier with big aperture permits viewing the subject with both eyes for greater comfort, ease and accuracy, and a considerable third-dimension effect. Focal distance of the lens is 250 mm. Magnification is 3x, increased to 5x if a secondary lens is used. Shade-protected, a circular lamp around the magnifier permits use in any area. it is of value for inspection of plates and engraving, assembly of precision instruments, film retouching, and a host of other purposes.

DANA
HULL-GARD

Revolutionary
BOAT TRAILER
uses—

NATIONAL
SPRING LOCK WASHERS

—for long-life dependability

FOLLOW THE LEADERS! Improve your products and reduce production costs with NATIONAL Spring Lock Washers or NATIONAL Retaining Rings. These economical fasteners make it possible to simplify designs . . . save on materials and weight, cut down production operations, facilitate assembly. Request catalogs, or ask NATIONAL for a recommendation on your specific design application.

The NATIONAL LOCK WASHER COMPANY
Serving Industry Since 1886
NEWARK 5, NEW JERSEY • MILWAUKEE 2, WISCONSIN

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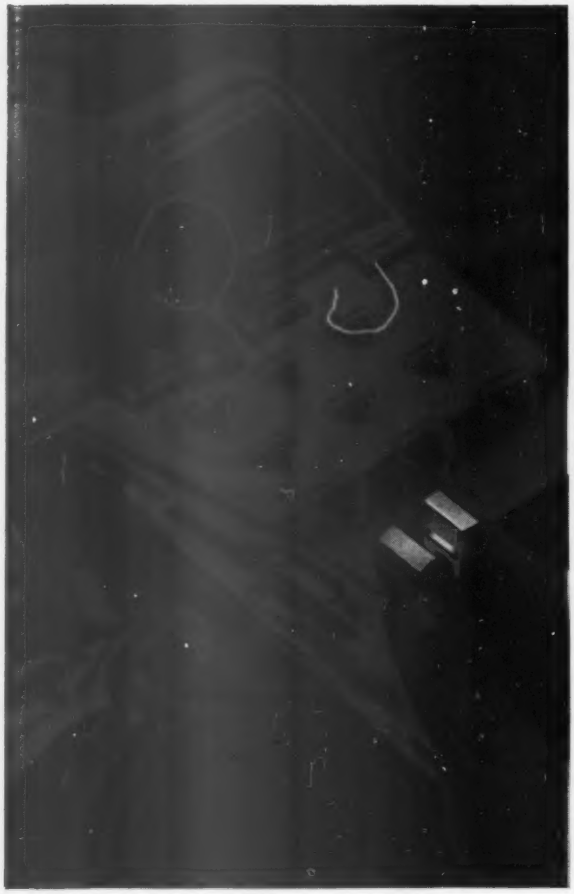


Engineered by Tinnerman . . .

One-piece **SPEED CLIP**® on O-Cedar Sponge Mop replaces 3 parts, eliminates riveting

O-Cedar put the squeeze on high assembly costs when they redesigned their famous squeeze mop. The first money-saving step was to call in Tinnerman fastening experts.

The result was a one-piece spring steel SPEED CLIP which replaced three separate parts and eliminated a riveting operation. This new fastener locks itself in place on the squeeze plate, and holds it up and out of the way when snapped over an anchor tab provided on the mop base. Live spring action assures positive retention for full mop life.

Assembly is faster, better and substantially reduced in cost!

Savings and improvements like these can be made in your product with SPEED NUT Brand Fasteners. If you'd like to have a Tinnerman FASTENING ANALYSIS made to help you find such savings possibilities, call in your SPEED NUT representative. The service is free . . . you'll find him listed in the Yellow Pages and in SWEET'S PD File under "FASTENERS." Or write direct.

TINNERMAN PRODUCTS, INC.
Dept. 12 • P. O. Box 6688 • Cleveland 1, Ohio

TINNERMAN
Speed Nuts®

FASTEST THING IN FASTENINGS®

CANADA: Dominion Fasteners Ltd., Hamilton, Ontario. GREAT BRITAIN: Simmonds Aerocessories Ltd., Treforest, Wales. FRANCE: Simmonds S. A., 3 rue Salomon de Rothschild, Suresnes (Seine). GERMANY: Mecano-Bundy GmbH, Heidelberg.

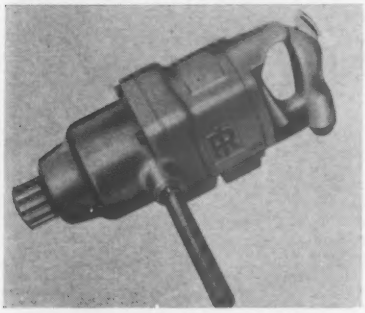
Use postpaid card. Circle No. 235

The unit has a 22 mm range of vertical and horizontal movement, 360-degree revolution. Its height is 300 mm. Bed measures 130 mm x 150 mm. Its secondary lens has a 64 mm diameter. The lamp operates on standard 100-110 V, using 20 watts.

Congress Company, 448 South Hill St., Los Angeles 13, Calif.

Use postpaid card. Circle No. 12

POWER TOOL HANDLES HEAVY NUT RUNNING JOBS



A pneumatic tool enabling one man to handle heavy nut running jobs usually requiring two men, has a 1½" bolt size capacity.

The tool weighs 33 lbs without the socket.

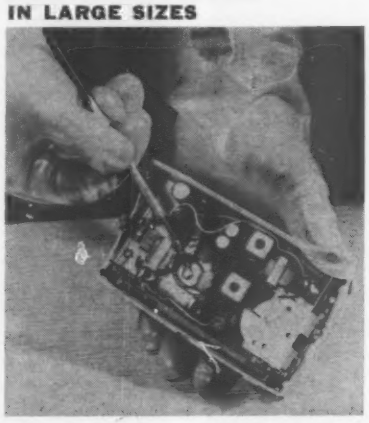
Having a 20% power increase with a six vane motor, the model 844 has a free speed of 3500 rpm at 90 psi air pressure.

The impact mechanism has an average rate of 700 impacts pm at 90 psi.

Ingersoll-Rand Co., 11 Broadway, New York 4, N.Y.

Use postpaid card. Circle No. 13

PLASTIC GLOVES NOW IN LARGE SIZES



Tissue-thin gloves of phylox, designed especially for jobs requiring extreme finger sensitivity and hand dexterity, are now produced in an extra large size.

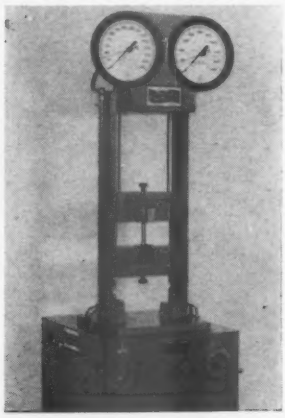
Non-allergenic, the phylox gloves are resistant to the acids, alkalis, oils, greases and some solvents usually encountered in light hand work.

Features of all four sizes, (small medium, large and extra large), include a 10½" length for ample wrist and lower arm protection, flare design of cuff opening for ventilation, textured inside finish, and non-slip grip when worn reversed.

Pioneer Rubber Co., 296 Tiffin Rd., Willard, Ohio.

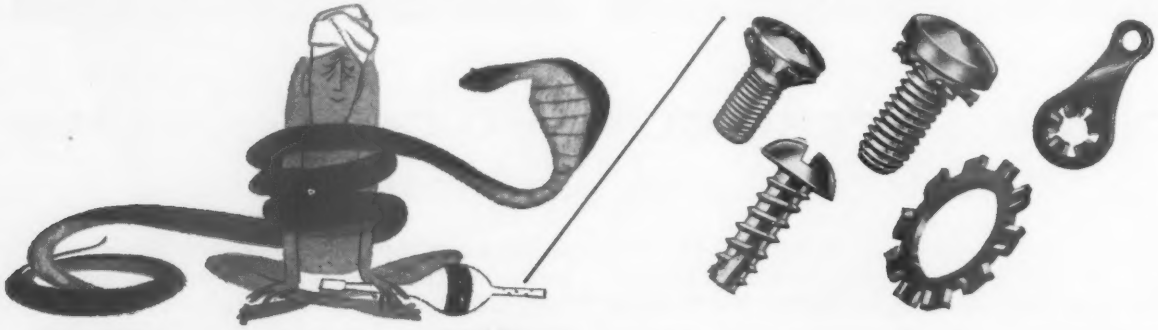
Use postpaid card. Circle No. 26

TENSILE TESTING MACHINE HAS 40,000. LB. CAPACITY



Vertical, floor-mounted tensile testing machines having capacities up to 40,000 lbs., are hydraulically operated. Controls are mounted on the front for ease of operation.

Stroke of the tensile tester is 4", and specimens up to 10" long and 2" wide can be accommodated. The compression



Togetherness

matters with industrial fasteners, too!

Togetherness, industrial style, has a special meaning at Thompson-Bremer because we are one of the few fully integrated manufacturers of Sems, lock washers, thread-cutting screws, terminals and cold-headed specialties. With our engineering services and components manufacturing together under one roof, we can give you faster, more individualized service at competitive prices. We'll bid on your specials requirements, or fill orders for standard items on short notice from the extensive line of EVERLOCK products stocked by your local distributor.

If you buy or specify industrial fasteners, you want whatever your company assembles to go together economically and stay together reliably. Send for catalog and samples or call your EVERLOCK representative.

AMF Everlock INDUSTRIAL FASTENERS

Thompson-Bremer & Co.
Division of
American Machine
& Foundry Company

Thompson-Bremer & Co., Dept. 6120
228 N. LaSalle St., Chicago 1, Ill.
Please send me:
_____ EVERLOCK fastener catalogs _____ samples of EVERLOCK industrial fasteners and cold-headed specialties.
Name _____ Title _____
Company _____
Street _____
City _____ Zone _____ State _____

Use postpaid card. Circle No. 236

testing area will accommodate specimens up to 4¾" high and 7" wide. A standard 40,000 lb capacity proving ring can be used to calibrate the testing machine.

The machines are available with one or two load gages. Model TE-40-A is illustrated. The machine measures 72" x 24" x 23", height, depth and width.

Steel City Testing Machine Inc., 8817 Lyndon Ave., Detroit 38, Mich.

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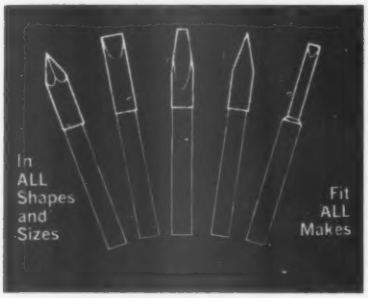
NON-FREEZING SOLDERING TIP FITS ALL IRONS

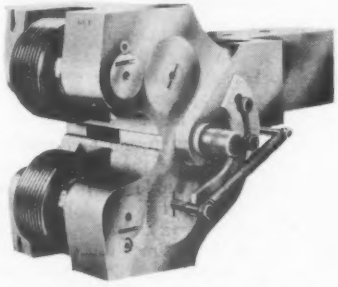


A soldering tip which cannot freeze or stick in the tip hole is made by a new anti-corrosion process to meet the needs of high-temperature, high-performance soldering irons. Durotherm has maximal conductivity and the shank is immunized so that solder will adhere only to the working surface—prevents solder from creeping into tip hole or dropping on components. It is made in diameters from ⅛" to ½" and in hundreds of lengths, shapes and tip points. The tool fits all makes of irons.

Hexacon Electric Co., 635 W. Clay Ave., Roselle Park, N.J.

Use postpaid card. Circle No. 15

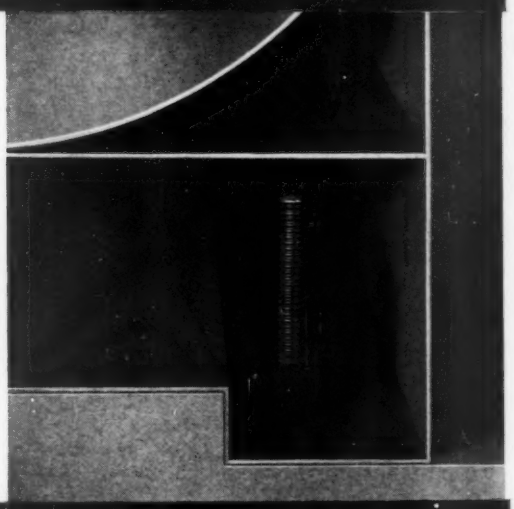
WIDE-RANGE THREAD ROLLING ATTACHMENT



A thread rolling attachment has been developed to roll a diametrical range from 1½" to 3¼". It is applicable to the larger automatic chuckers and bar automatics and also turret and tracer lathes equipped with power cross feed.

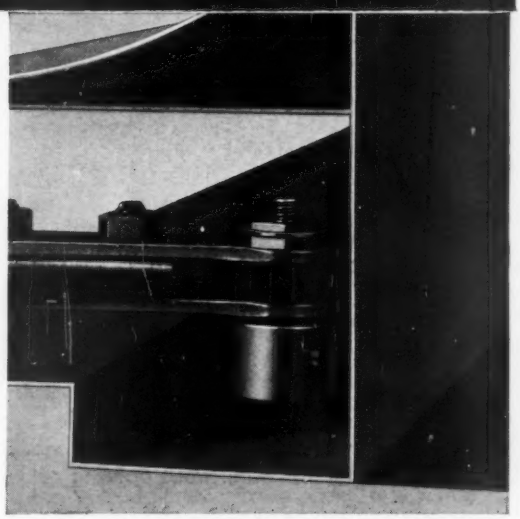
The Lanroll attachment's helix angle bushings permit helix angle agreement between the thread rolls and the workpiece to eliminate thread drunkenness and rolling through a class 4 fit. Its hinged construction and size adjusting link allow a wide diametrical range while the use of proper thread rolls

the most difficult fastening jobs . . .



Running a nut down on a stud is a very simple job, unless the stud is confined in a deep recess where a straight tool can't reach it, and where an angle tool won't provide the necessary clearance for the stud.

. . . can be simplified with APEX Fastening Tools



In this case, you merely put an Apex bolt-clearance type socket, designed for use with ratchet wrenches, on the tool, and you'll find you're right back to a very simple nut running job.

That's the way it goes with the difficult fastening jobs . . . Nearly all applications can be handled easily and economically with one of the more than 5,000 stock types and sizes of Apex Nut Running Tools. And for those few unusual applications, "we quote promptly on specials."

If you fasten anything with nuts, bolts or screws, write, on your company letterhead please, for **CATALOG 30-A** Nut Running Tools, ¼" to ⅝" square, hex drives. **CATALOG 30-B** Nut Running Tools, ¾" to 3½" square, hex drives. **CATALOG 30-C** Screwdriving Tools.

SCREWDRIVING • NUT RUNNING • SPECIAL

Use postpaid card. Circle No. 237

SUNBURST® SERIES PLASTIC FASTENERS

Two easy steps—place fastener in hole . . . push with simple tool. Fastener pulls up and provides tight, vibration-free lock due to toggle action of radial webs opening out.

Fastener illustrated is a trim moulding retainer in nylon. The Sunburst principle can also be applied to wire straps, tubing retainers, and other assembly fasteners in polypropolene, nylon or similar materials.

Write today, outlining your fastener needs, for complete details and samples.

ROBIN FASTENER

ROBIN PRODUCTS COMPANY
27027 Groesbeck Hwy.
Warren, Michigan

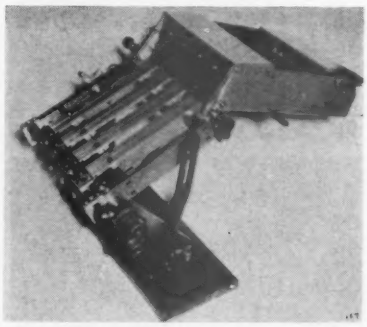
Use postpaid card. Circle No. 238

and auxiliary equipment allow left or right hand, straight or taper threads to be produced.

Landis Machine Co., Waynesboro, Pa.

Use postpaid card. Circle No. 16

HEADED PARTS ORIENTED IN VIBRATING FEEDER



Headed parts feeder features orientation and escapement as a built in feature.

Oscillation of pan activates parts which are oriented and fed to stationary tracks. Parts are then removed from the tracks with standard escapement, one at a time.

Feeders can be adjusted for numerous size shanks and lengths, feeding up to four parts at one time.

William S. Doig, Inc., Maple Ave., Haverstraw, N.Y.

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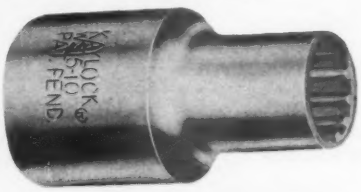
NEW TORQUE SOCKET REDUCES BREAKAGE



Costly socket breakage and wrenching failures are reduced by a new super torque socket. It is designed especially for high torque applications in the aircraft and missile industries.

Tests by major airframe and engine manufacturers under the most severe conditions were unable to produce a wrenching failure; and in laboratory tests, the socket was undamaged after being subjected 100 times to more than double the torque load specified for standard tests.

Lobes of the new socket grip the wrenching flats, instead of the points, eliminating any tendency to slip or to round the points of either the nut or the socket.

The new torque socket is made of heat-treated alloy steel and comes in nickel or chrome-plated finishes. It is available in 1/4 to 9/16 sizes.

Kaylock Division, Kaynar Mfg. Co., Inc., Box 2001 Terminal Annex, Los Angeles 54, California.

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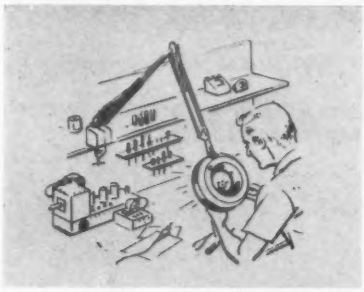
MAGNIFIER LAMP READILY ATTACHED TO BENCH



Providing shadow-free light in the viewing area, fluorescent illuminated magnifier inspection lamp readily attaches to inspection or assembly bench.

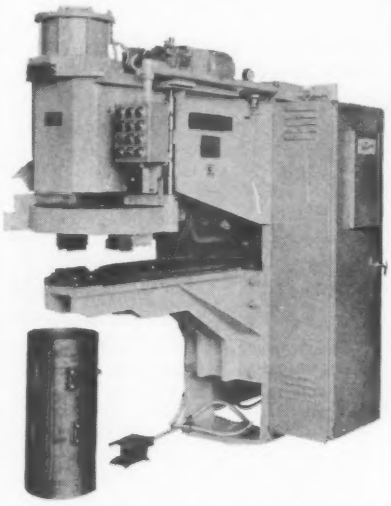
The 4X, 3 diopter lens, increases precision during intricate assembly operations, and allows for a more effective inspection.

Lens and light can be tilted, turned, raised, and lowered to any angle and will remain in set position.

Luxo Lamp Corp., Dock St., Port Chester, N.Y.

Use postpaid card. Circle No. 19

FOUR STATION DIAL TYPE PROJECTION WELDER

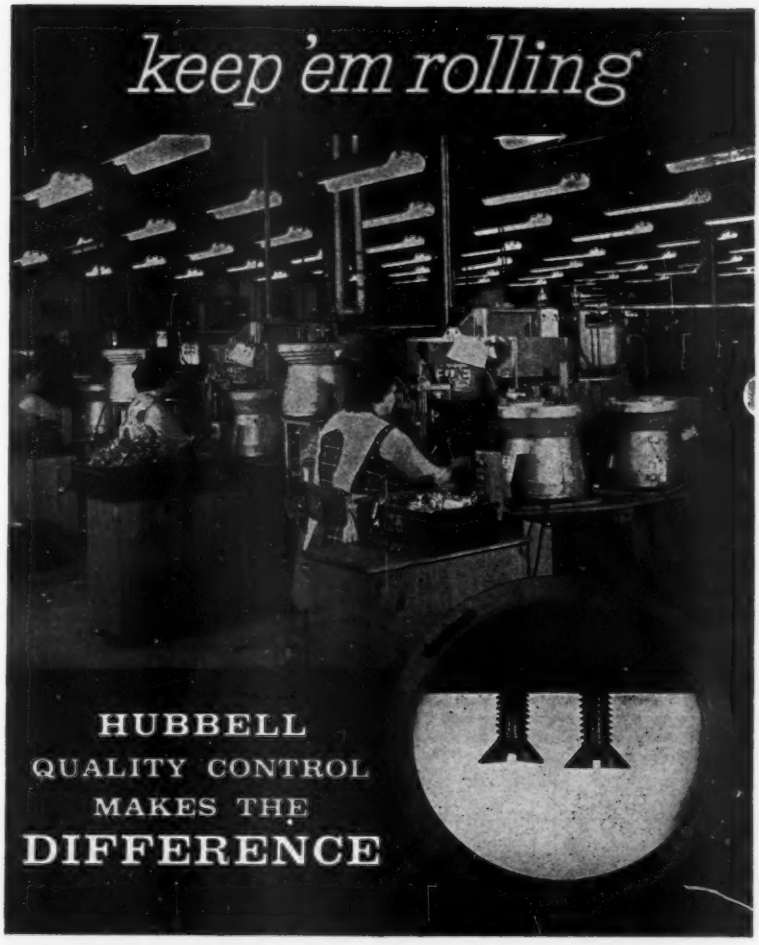


A projection welder, equipped with a special four-station dial-type upper die holder, allows selection of four different weld forces through a four-position push button station.

The dial-type head automatically moves the die selected to the weld station and automatically selects proper air pressure and heat setting.

A two-position switch is manually initiated. The first position brings the head down only, so that position can be checked. The second position initiates the weld timer sequence.

The machine has a throat depth of 48" from center line of slide to the frame's front face, and is powered with a 500 kva water cooled transformer, with 16 heat regulation steps. Anti-



Without any warning, this smooth rolling production line could come to a screeching halt . . . all because of one imperfect fastener. You've had it happen all too often. Suddenly an automatic machine clogs and everything stops dead and stays stopped until the clogged machine can be fixed.

Hubbell precision fasteners are your best insurance against production snafus like this, because they are quality controlled at every step of manufacture to provide as uniformly perfect cold headed products as is humanly possible. It's our job to weed out the duds like the one at left in the viewmaster above, and supply uniformly perfect fasteners like the Hubbell one at right.

Contrast the two. Note how the Hubbell fastener at right is completely free of burrs or dirt that might jam an automatic machine. Also see how sharp and clean the threads are, and how deep and precise the slot. All these things add up to faster production, less down time, fewer rejects and a better end product.

Yes, if it's easier to fasten, it's easier and cheaper to assemble. Buy Hubbell precision fasteners and see.

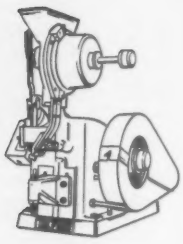
IT PAYS TO HAVE HUBBELL GOOD CONNECTIONS

Quality FASTENERS

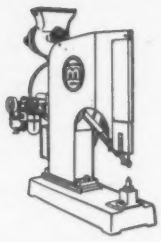
HARVEY HUBBELL, INCORPORATED
Machine Screw Department, Bridgeport 2, Connecticut

See the Hubbell Fastener Catalog in Sweet's Product Design File 7/Hu.

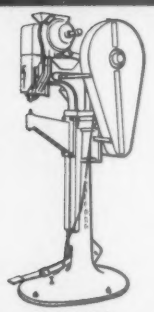
Use postpaid card. Circle No. 239



Model 52-S-55



Model 56



Model 250

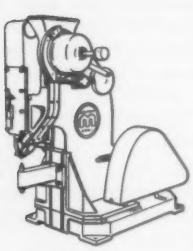
MILFORD'S FLEXIBLE RIVETER LINE CAN HELP CUT YOUR ASSEMBLY COSTS

Bench or Pedestal Models
Mechanical or Pneumatic Operation
Single or Multiple Spindle

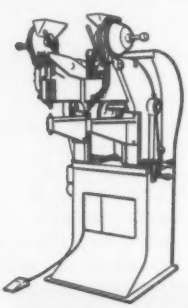
Milford adapts to your production line with a wide range of automatic riveters designed to cut assembly costs. Count on Milford's versatility to come up with the answers you need at substantial cost savings over other fastening methods.

Milford's MANUAL OF RIVETING PRACTICE may have the answers to your riveting and assembly problems. Ask your Milford Representative to show you how to use the ideas in this manual to cut production costs.

Model 423



Model 53



Model 72

THE MILFORD RIVET

MILFORD RIVET & MACHINE CO.

MILFORD, CONNECTICUT • NORWALK, CALIFORNIA
ELYRIA, OHIO • AURORA, ILLINOIS • HATBORO, PA

Use postpaid card. Circle No. 240

friction, roller bearing, slide operated air cylinder develops approximately 9000 lbs. weld force at 80 psi.

The Federal Machine and Welder Co., Warren, Ohio.

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DESK TALLY COUNTER WITH SUBTRACTION DEVICE

Desk tally counter equipped with a patented subtraction device is used as a counter for perpetual stock and inventory control. Mounted on the stock bin, the counter gives instant visual inventory count.

The HK-26 plus or minus counter can also be used for all hand counting at insp tion, checking and assembly stations.

Infotronics Co., PO Box 124, River Forest, Illinois.

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HIGH SPEED HAND WELDER FOR THERMOPLASTICS

An all purpose hand welder is designed for tacking thermoplastics such as polyethelene, polypropylene, PVC, and plasticized tank lining. The Kamlar model 12-AW can be used for both shop and field work, with a production-rate of up to 60 inches per minute.

The unit has a three heat element with an output of up to 800 watts, specially designed tacker and round tips which maintain constant flow of high temperature air through the tips. The unit can be plugged into any 115 volt a.c. outlet.

Kamlar Products Co., 932R Washington St., Norwood, Mass.

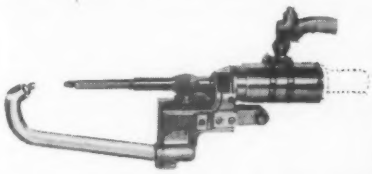
Use postpaid card. Circle No. 22

HIGH PRODUCTION PORTABLE WELDING GUNS

The C-Type, Craft portable welding gun is designed to attain maximum output on the production line by achieving unusual compactness and ease of handling.

Dotted lines in the illustration indi-

cate the amount of bulk saved by the compact design of the retraction cylinders. The size reduction makes the gun easier to handle. Mounting holes for



attaching accessory bails or hangers are located at optimum balance points to makes the guns easy to manipulate.

Kirkhof Manufacturing Corp., 2450 Buchanan Ave., S.W., Grand Rapids 7, Michigan.

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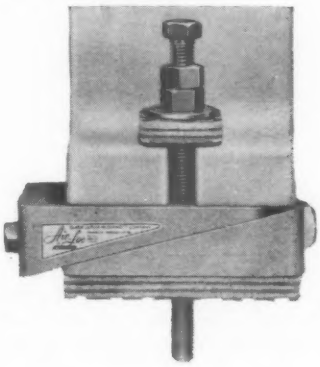
MACHINE MOUNT CONTROLS VIBRATION

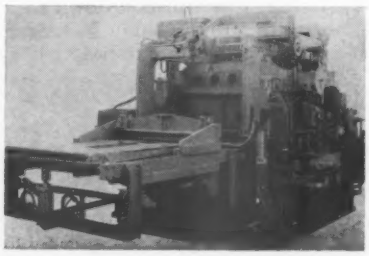


Designed for control of vibration where bolting of machine to the floor is required by safety code regulations, the Bolt-Thru wedgmount, reduces vibration up to 85%. Precise leveling of machines is made possible because of its double wedge construction.

Clark, Cutler, McDermott Co., 8 W. Central St., Franklin, Mass.

Use postpaid card. Circle No. 24

WELDER PRODUCES SMOOTH TRIMMED WELD JOINT

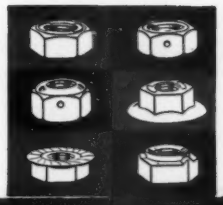


Welder produces a sound weld, trimmed smooth to the strip thickness, suitable for further cold reduction.

Positioning the ends of two strips, it flash-welds them, traverses the joint to a draw-type, multiple-cutter trimmer which smooths the top and bottom surfaces.

Taylor Winfield Corp., 1048 Mahoning Ave., Warren, Ohio.

Use postpaid card. Circle No. 25



One of these CAN IMPROVE YOUR PRODUCT . . .

SIX GREAT
MACLEAN-FOGG
LOCK NUTS

MF **UNI-TORQUE**	A free starter with lock at the top. Withstands severe vibrations. Cuts assembly time.
MF **TWO-WAY**	The Lock's in the center of nut. Can be applied from either end. Permits bolt end to be flush with, or below, top of nut.
MF OPEN END **CAP NUT**	Has two-way center-of-nut lock. Used on furniture, appliances, toys, lawn mowers, tools, etc.
MF UNI-TORQUE **FLANGE NUT**	Combination lock nut and washer. Use on oversized holes; where extra bearing surface is needed.
MF **"WHIZ-LOCK"** FLANGE NUT	This one spins on. Serrations take a firm grip on work. Break loose torque higher than seated torque.
MF PILOT TYPE **WELD NUT**	You can have it with or without lock. Simplifies assemblies by means of self-locating pilot.

CIRCLE NUMBER FOR ILLUSTRATED CATALOG

SEE OUR CATALOG IN SWEET'S

MAC LEAN-FOGG
MF LOCK NUTS

MacLean-Fogg Lock Nut Company
5535 N. WOLCOTT AVENUE
CHICAGO 40, ILLINOIS

Need Lock Nut Advice? Phone ED 4-8420 Collect. DO IT TODAY.

Use postpaid card. Circle No. 241

FASTENOMICS

TIPS ON FASTENER APPLICATIONS BY STANSCREW

Coarse Threads . . . Fine Threads . . . Which One . . . When?

What's the difference?

Coarse threads conform to Unified National Coarse (UNC) standards while fine threads are governed by Unified National Fine (UNF) standards. Both include precise, detailed specifications for all thread dimensions and proportions.

UNF standards specify substantially more threads per inch. The following table illustrates the range of difference in various diameters.

Diameter of Fastener	UNC Threads Per Inch	UNF Threads Per Inch
¼"	20	28
⅜"	16	24
½"	13	20
¾"	10	16

Coarse thread advantages

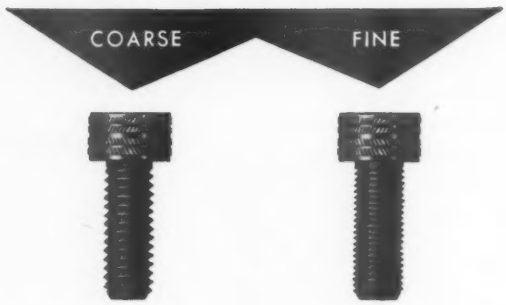
For the great majority of applications, fasteners with coarse threads are used because of these advantages:

1. They assemble easier and faster . . . provide a better start with less chance of cross threading.
2. Nicks and burrs from mass handling are less liable to affect assembly.
3. More clearance provided for plating.
4. Less liable to seize in temperature applications and in joints where corrosion will form.
5. For threading into lower strength materials, coarse threads are less prone to strip.
6. Extreme difficulties are encountered in attempting to tap fine threads in brittle or friable material.

Fine thread advantages

In some applications, fine threads provide a superior solution because of these advantages:

1. They are some 11% stronger than coarse threads due to greater cross-sectional area.



Two ⅜" x 1" socket cap screws. Coarse thread (UNC) has 16 threads per inch; fine (UNF) thread 24.

2. In very hard materials, fine threads are easier to tap.
3. They have better fatigue life than coarse threads.
4. They can be adjusted more precisely when a cotter key is used.
5. Where the length of engagement is limited, where a smaller lead angle is required, or where the wall thickness requires a smaller thread, fine threads should be used.

Don't overload inventory

In trying to establish the best possible fastener for each application, don't stock too many fasteners and overload your inventory. A good rule of thumb is "one thread for a given size and grade of fastener" . . . choosing the type of thread which is best for all applications involving that size and grade. In many cases this will boil down to a coarse thread, since the group will probably include a tapped hole in a friable or low strength material.

For further information

For more detailed information, or the answer to a specific problem, call in your Stanscrew fastener specialist. He is quickly available through your local Stanscrew distributor . . . also your source for Stanscrew's complete line of over 5,500 different types and sizes of dependable fasteners.

STANSCREW FASTENERS

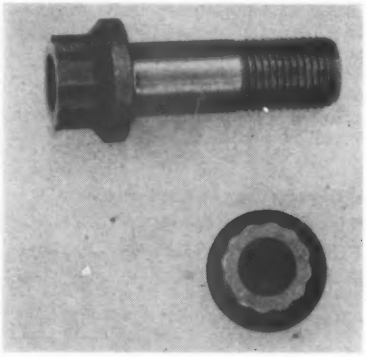
CHICAGO | THE CHICAGO SCREW COMPANY, BELLWOOD, ILLINOIS
HMS | HARTFORD MACHINE SCREW COMPANY, HARTFORD, CONNECTICUT
WESTERN | THE WESTERN AUTOMATIC MACHINE SCREW COMPANY, ELYRIA, OHIO

STANDARD SCREW COMPANY 2701 Washington Boulevard, Bellwood, Illinois

Use postpaid card. Circle No. 242

WHAT'S NEW IN FASTENING AND JOINING

For further information on any of the fasteners or methods use the handy postpaid card opposite page 66.



(See 30)

GREATER PRELOADS WITH HIGH TORQUING BOLTS

Twelve-point external wrenching bolts of high-tensile steel and high-temperature heat resistant materials offer unique advantages in high torquing for greater preloads where required.

The head will accept standard box and socket wrenches.

Stocked in standard sizes, the bolts meet the requirements of MS9033 through MS9039 for high temperature use and MS9088 through MS9152 for high strength-weight ratios.

Mercury Air Parts Co., Inc., High Temperature Division, 9310 W. Jefferson Blvd., Culver City, Calif.

Use postpaid card. Circle No. 30

(See 31)

HARDWARE ADAPTED FOR ELECTRONIC CABINETS

A line of closing, latching, locking, and door-bolting hardware has been adapted to the electronics field from aircraft interior and door hardware items.

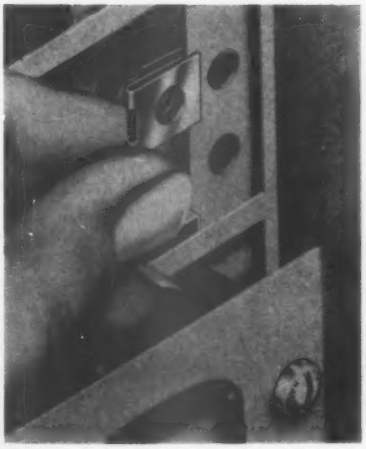
All the products feature the compactness, lightweight, and strength required in aircraft application. Stainless steel and aluminum alloy are the most used materials.

The products include flush latches in various sizes for horizontal or vertical installation in metal cabinets, on hinged panels, doors, or drawers. These are available with or without key-operated cylinder locks.

Door-bolting systems for doors or panels which must be secured with a positive seal, as well as quick release latches are also included.

Adams Rite Manufacturing Co., 540 W. Chevy Chase Dr., Glendale 4, Calif.

Use postpaid card. Circle No. 31



(See 32)

CLIP-ON RECEPTACLE FOR ¼-TURN FASTENERS

Clip-on receptacles for use with Lion No. 2 quarter-turn fasteners slip over a punched or drilled hole and lock in place.

The hardened steel, cadmium-plated clip accommodates frame thicknesses of .055" to .090". A float tolerates misalignment of parts.

Where pre-punched channels are used, the receptacles can be moved from hole to hole to adjust for units of various sizes. The clips are removed by sliding a knife blade under the clip leg and down across the hole.

The No. 2 stud, which fits in the receptacle, slips through the hole and captivates with a split ring retainer.

Southco Div., South Chester Corp., Industrial Hwy., Lester, Pa.

Use postpaid card. Circle No. 32

NON-RESINOUS WATER-BASED FLUXES INSTANTLY SOLUBLE

Non-resinous water-based fluxes feature instantly soluble and non-charring residues. They are available in four grades to provide sufficient activity for any job, while holding residues to a minimum for the soldering speed required. The grade descriptions are No. 3355 red for fast action and medium residue, No. 2133 pink for rapid action and moderate residue, No. 3133 pink for medium action and minimum residue, and No. 735 blue for medium action and light residue.

Typical applications include transistors, diodes, magnets, refrigerator parts, prong soldering, roller soldering, terminal boards, connectors and electrical components.

London Chemical Co., Inc., Dept. AE-3, 1535 North 31st Ave., Melrose Park, Ill.

Use postpaid card. Circle No. 33

FASTENERS COLOR-CODED BY TITANIUM COLORING PROCESS

A unique process coats titanium in brilliant and uniform colors without the use of harmful dyes or paints. Multicolors can be applied to a single piece of titanium. The coloring process features two benefits to products. One is resistance to chemical corrosion while the other is the ability to remain colorfast to temperatures to 600°F. and legible after extended exposure to 1000°F.

These two benefits make the process suitable for high temperature name

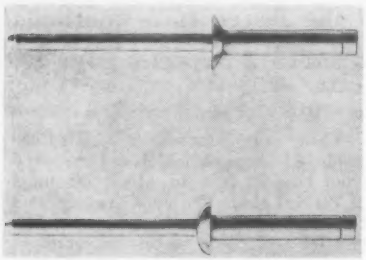
plates and the color coding of fasteners, valves, nuclear reactor components as well as chemical pipes and fittings. Additionally, many commercial titanium products can be eye appealing as well as corrosive resistant.

The coating, when applied to titanium nuts and bolts, alleviates the galling condition normally encountered on male and female thread combinations.

Hi-Shear Corp., 2600 W. 247th St., Torrance, Calif.

Use postpaid card. Circle No. 34

RIVETS HAVE MINIMUM BLIND SIDE CLEARANCE



Rivets which speed production and reduce costs in either blind or open applications are designed for both production manufacturing and for repair.

The rivets have minimum blind side clearance, adaptability to different material thicknesses and positive hole-fill.

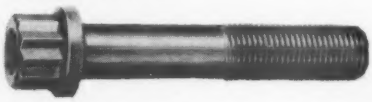
Available in structural and non-structural types, the rivets are applied by one man from one side of the work. Rivet stems fracture cleanly and quickly.

Universal or countersunk heads in grip lengths from 1/32 to 1", and diameters from 1/8" to 1/4" are available.

Cherry Rivet Division, Townsend Co., Box 2157-Z, Santa Ana, Calif.

Use postpaid card. Circle No. 35

STRONGER HIGH TEMP BOLT SAVES WEIGHT



Significant weight savings in missiles and airframes, jet and rocket engines, and power equipment is possible with a new 1200° bolt.

The new bolts have 39% greater tensile strength and 54% higher stress rupture strength than current elevated temperature bolting used in the 900 to 1200° range.

Intended for applications where bolting made from A-286 alloy is currently used, the EWB-1218 fastener is made by special processing techniques from U-212 material, an iron base alloy similar to A-286, with additional alloying.

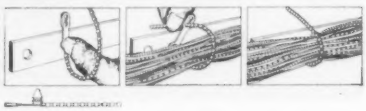
The new series has a minimum stress rupture strength of 100,000 psi for 23 hrs at 1200°.

The bolts are made in diameter sizes from No. 10 to ½" with fine threads. All parts are inspected with fluorescent penetrant per MIL-I-6866.

Standard Pressed Steel Co., Jenkintown, Pennsylvania.

Use postpaid card. Circle No. 36

WIRE TIE ELIMINATES CABLE CLAMPS



A combination wire-tie - cable clamp, cuts material costs and speeds assembly by eliminating separate cable clamps, mounting screws and wire ties in many applications.

The unique push-button snaps into any .250 to .265" diameter hole, securely fastening the tie to the chassis or frame. The tie adjusts to 30 different sizes from 1/8 to 1-5/16" diameter and can be opened and closed to add or repair wires without removing the push-button mounting.

Richco Plastic Co., 3722 W. North Ave., Chicago 47, Ill.

Use postpaid card. Circle No. 37

APPLIES SEALANTS BY MASS PRODUCTION METHOD

The selective placement of sealing material can be applied in almost any position, shape or form on metal stampings, plastic parts, nuts and nut-washer

PAN AMERICAN SCREW
CORPORATION

SCRULOX
SQUARE RECESS
SCREWS
REMARKABLE STARTING
AND DRIVING EASE
FASTER DRIVING WITH NO REAMING OF RECESSES OR SCARRING FINISHED SURFACES
Cone bottomed recess for positive CENTERING and square planes of recess for maximum turning power and TORQUE which prevents reaming of square recess screws.
FAR GREATER DRIVER AND BIT LIFE WITH SQUARE DESIGN
NO REAMING • NO SLIP • NO SCARS
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MORE DRIVER LIFE • BETTER FITS
Two DRIVERS DRIVE 85% OF SCREW SIZES
DRIVER BITS SUPPLIED FOR ALL ELECTRIC, PNEUMATIC, AND HAND DRIVERS
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For 0 2 3 4 5 6 8 10 12 14 16 ga. screws

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JACKSONVILLE FLORIDA, U.S.A.
IN CANADA
P. L. ROBERTSON MFG. CO. LTD. MILTON, ONTARIO
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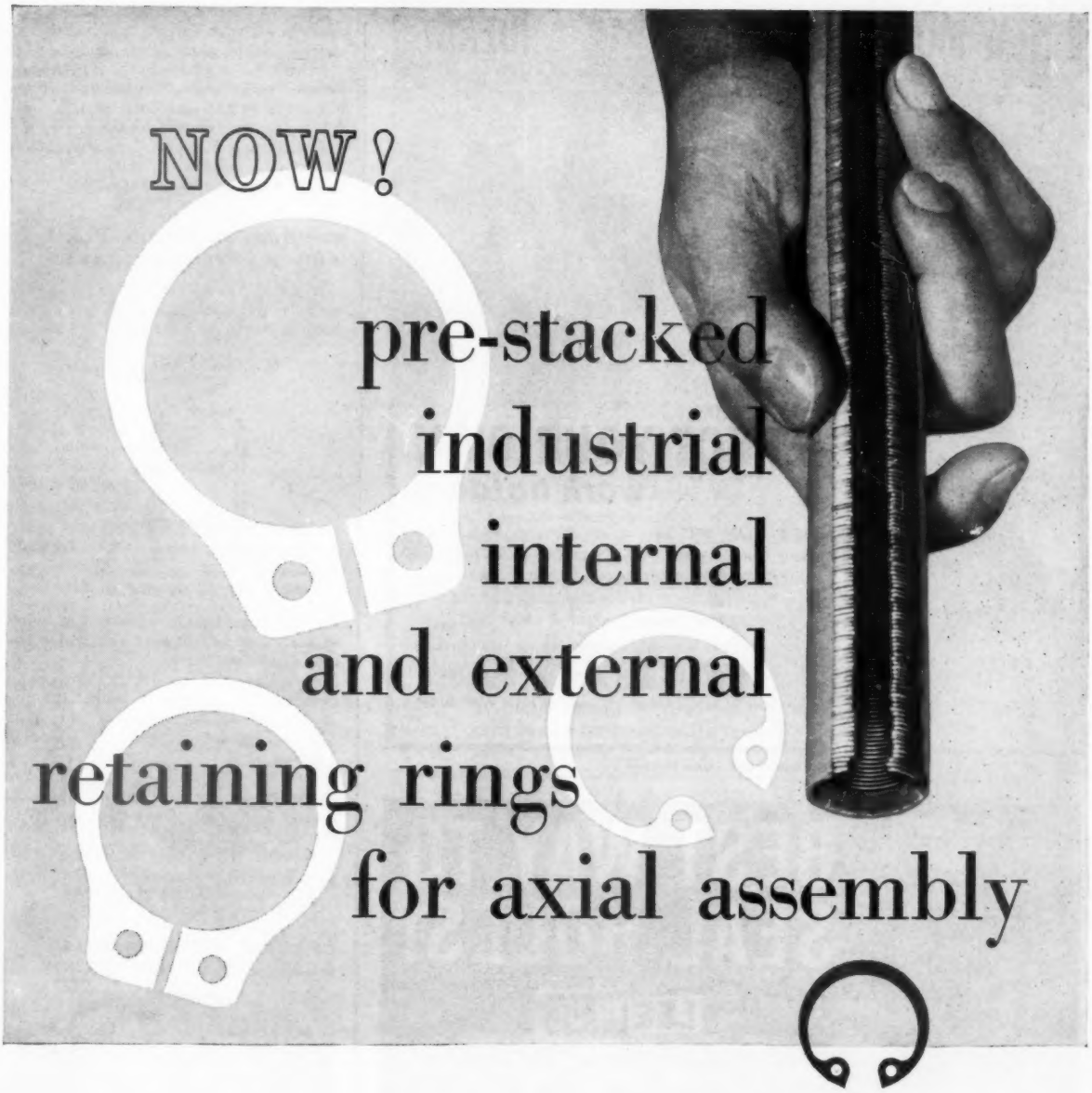

You can now get Industrial Series 3000 and Series 3100 Retaining Rings, PRE-STACKED — in the most popular sizes — from .250" to 1.375". You can get them immediately and for no more than you have been paying for bulk rings.

These Industrial Retaining Rings — both INTERNAL and EXTERNAL — come pre-stacked, with lugs aligned, in stacks of 250 . . . ready for automatic or semi-automatic dispensing.

You need waste no time untangling snarled rings — you don't have to guess at inventories on hand. And, you don't have to pay any premium for these money saving conveniences.

Your IRR Distributor carries Industrial Pre-Stacked Retaining Rings . . . or, write us for complete information.

Send for Catalogs No. 30A and 31A.

IRR *Originators of modern retaining ring dispensing*

INDUSTRIAL RETAINING RING COMPANY

57 Cordier Street, Irvington 11, New Jersey

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2 NEW MONEY SAVING IDEAS!
the productivity of PowRarm,
the flexibility of
ERECT-YOUR-OWN!
ERECT-YOUR-OWN WORK HOLDER
POWRARM WORK POSITIONER
ERECT-YOUR-OWN COMPONENTS...
Complete Kit No. 391 includes two 18" perforated aluminum strips, ⅛" thick, three 90° connecting angles, two toggle clamps, 12 screws and nuts. Each part may also be ordered individually.
ERECT-YOUR-OWN
work holders
NEW FROM WILTON... a versatile work holder that's perfect for light production and assembly. Quickly and easily changed for different jobs—a screwdriver is all that's needed. May be put together in any size or shape by production line operators. Use with Wilton PowRarm or bolt to bench.
Attach This Ad To Your Letterhead And Mail For Free Literature!
WILTON AFE 11
WILTON TOOL MANUFACTURING CO., INC., SCHILLER PARK, ILLINOIS
SOLD BY LEADING DISTRIBUTORS THE WORLD OVER
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BEST WAY TO SEAL HOLES!
LEE PLUG
Simply place plug in reamed hole. Drive in tapered pin until ends are flush. Controlled expansion causes grooves to "bite" into casting, assures a bone dry seal that withstands pressures up to 40,000 psi. Now widely used on aircraft and missiles, and for pumps, servo valves, regulators, etc.
*Pat. #2,821,323
LEE COMPANY
OLD SAYBROOK CONN
WRITE TODAY FOR COMPLETE ENGINEERING DATA
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assemblies, wire forms, washers, bolts, screws, rivets, studs, clips, etc.

It can be applied by a newly developed mass production method which eliminates after-assembly sealing, effecting savings in cost and time.

Automotive Rubber Company, 12550 Beech Rd., Detroit 39, Mich.

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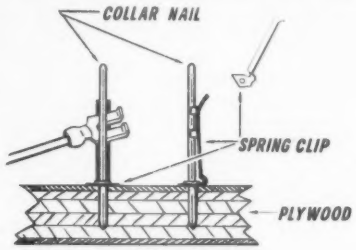
CONDUCTOR SPRING CLIP AIDS HARNESS ASSEMBLY

A conductor spring clip used with a collar nail, to aid in the use of harness board assembly, was especially designed



TYPICAL USE OF SPRING CLIP

to hold lugs (spade or ring), or wire, in place, yet permit easy removal without damaging them.

A collar nail is driven through a hole in the clip which brings the top of the clip taut against the nail. This spring action holds the spade in position.

The SC-101 clips are made from hardened spring steel and are approximately 1⅛" high. They are used with standard collar nails.

Stevens Cress Co., 39 Union Ave., Cresskill, N.J.

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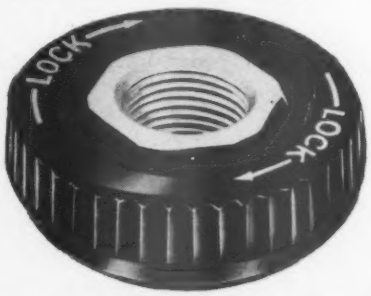
CONTROL KNOB LOCK IS DUST AND SPLASH PROOF



A splash-proof, dust-proof version of a control knob lock is designed for exterior use with potentiometers and other variable controls.

Water leakage is prevented around control shafts by a special rubber insert molded over the threaded metal bushing of the knob lock.

The knob lock is mounted directly on the threaded bushing of the control. A ⅛th turn of the fluted skirt firmly locks the control without disturbing the critical control settings.

Built to military specifications, the units have passed all standard shock,

vibration, salt spray, and humidity tests.

Raytheon Co., Industrial Components Division, 55 Chapel St., Newton 58, Massachusetts.

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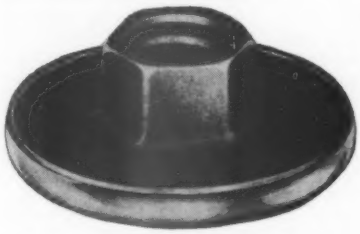
FASTER ASSEMBLY WITH CAPTIVE WASHER NUT



A captive washer nut helped to solve a loose washer problem and also led to important space and weight savings in the newly designed terminal block recently introduced by Lockheed Aircraft Corporation.

The lightweight, self-locking nut used in each of the terminals has an integral free-spinning washer that completely eliminates the possibility of a washer dropping off into places where it might do damage.

Requiring less wrench clearance, the captive washer nut speeds assembly and also eliminates extra motions once required to attach washer to bolt.

Kaylock Division, Kaynar Mfg. Co., Inc., Box 2001 Terminal Annex, Los Angeles 54, California.

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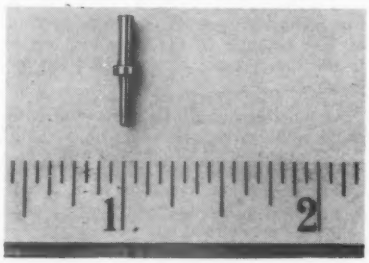
TAPER PIN PLUGS PROVIDE SOLID METAL CONNECTION



Two new machined taper pin plugs, solder type and solderless type, for use in connections of circuits of all kinds provide a solid metal connection.

The plugs are .053" in diameter with .061" taper per inch. Plugs are brass per QQ-B-626a, Comp. 22, ½ hard, finished with .0002" silver plate plus .00010" gold plate or .0001" copper plate and .0005" electro-tin plate.

Cambridge Thermionic Corp., 445 Concord Ave., Cambridge 38, Mass.

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SOLDER-TYPE ALLOY FOR ELECTRONIC ASSEMBLY

A solder-type alloy designed especially for electrical and electronic work is 50% more electrically-conductive than the standard 50-50 lead-tin solder. Its high-active flux core is inert after

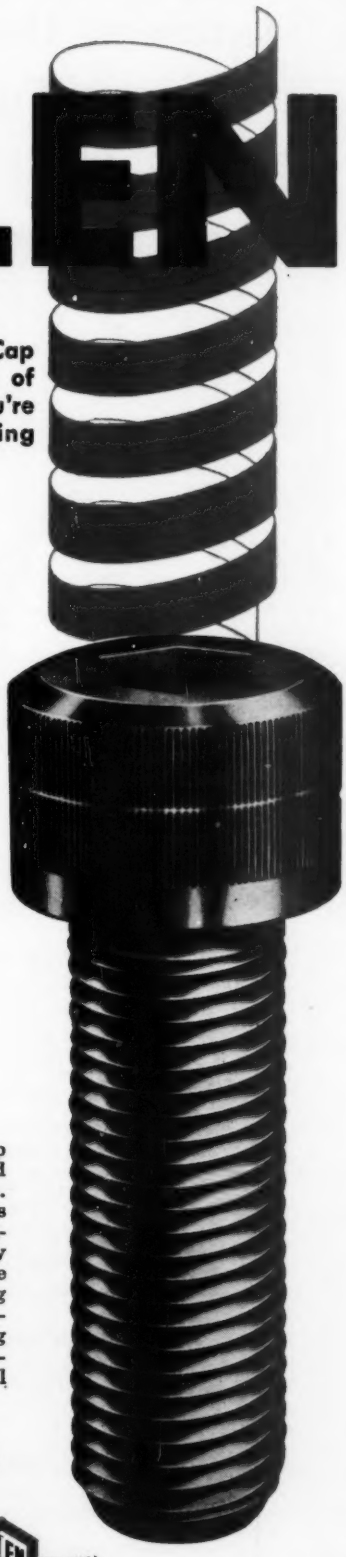
ALLEN

The cost of ALLEN Hex-Socket Cap Screws is only a minor fraction of your assembly costs . . . be sure you're getting the timesaving, cost-saving advantages of genuine Allens!

Ever since Allen first produced the hex socket head screw nearly fifty years ago, specifying *genuine* Allens (made by Allen of Hartford) has been a sure way to guarantee dependable threaded fastening.

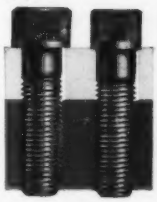
Only *genuine* Allens have Leader Points that make starting easier, and greatly minimize danger of cross threading. *Genuine* Allens are "pressur-formed" to preserve the long fibers uncut throughout the length of the screw, giving stronger sockets for greater tightening torque.

Write for samples and engineering data. See how *genuine* Allens will make your product better.



ALLEN HEX-SOCKET SCREWS HEAD

Allen's new 1960 Series Socket Head Cap Screws give up to 2½ times more load carrying capacity, without indentation. Head diameter of sizes from ¼" up is now uniformly 1½ times the body diameter—providing more under-the-head bearing surface, and a proportionate increase in clamping force. Write for new Bulletin G-25, with full specifications.



Stocked and sold by leading Industrial Distributors everywhere

50 ANNIVERSARY YEAR ALLEN HEAD (1910-1960)

ALLEN MANUFACTURING COMPANY

HARTFORD 1, CONNECTICUT, U.S.A.

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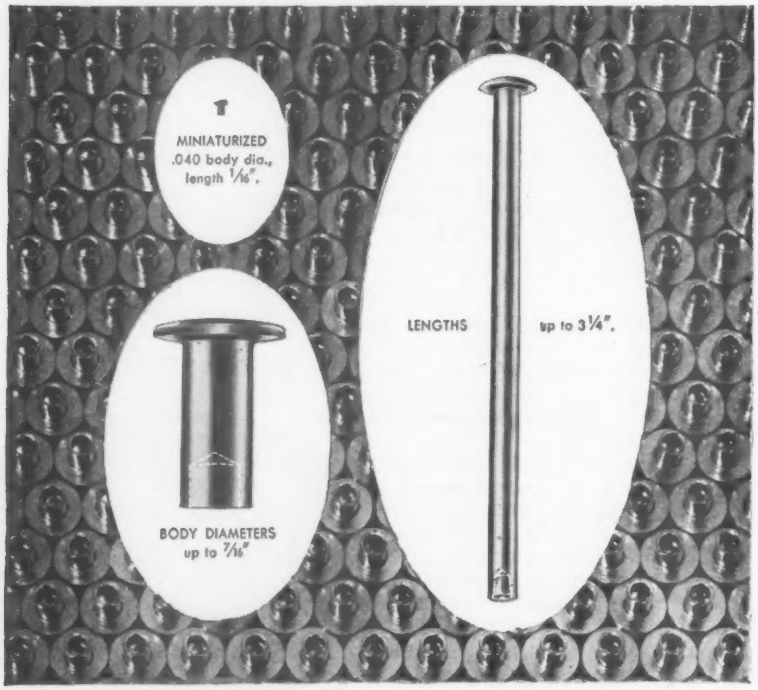
Look at this Size Range of Semi-Tubular Rivets... it's the way to lower cost



Miniaturized components and also large complete assemblies can now have all the money-saving advantages of using single and multiple automatic riveting. This is due to the wider size range of semi-tubular rivets now available and which can be used in conjunction with motor and pneumatic driven automatic riveting machines.

Today, there is hardly a fastening problem, involving even fragile materials, that does not warrant consideration of low-cost semi-tubular rivet setting.

Our Factory Riveting Specialists are ready to help you obtain the REAL COST FACTS on your own specific fastening problem. There is no obligation.

FOR YOUR FILES

Chicago Rivet Catalog describes 1388 standard tubular and split rivets and 25 single and multiple automatic rivet setters.

AIR-POWERED RIVETING

contains description and specifications of 8 single, multiple riveters— also rivet setters designed for automated operation.

Chicago Rivet & MACHINE CO.

946 So. 25th Ave., Bellwood, Ill. (Chicago Suburb)
Branch Factory: Tyrone, Pa.

Use postpaid card. Circle No. 248

carbonization, with residues which are non-corrosive and non-conductive and do not support fungus growth. Low melting point, and high solidification rate to prevent hot-shorting and minimize joint movement while plastic, are other features of this new alloy.

Neu-Tec-Tronic 157BN can be applied with soldering iron, torch, by hot plate or induction heating. Deposits will accept a wide range of plating including gold, silver, nickle, platinum, and cadmium. Available in 0.030 and 1/16" sizes.

Eutectic Welding Alloys Corp., 40-40 172nd St., Flushing 58, N.Y.

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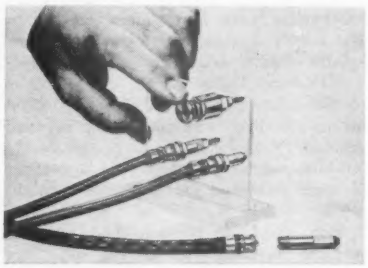
QUICK CHANGE IN AIR CIRCUITS WITH CONNECTOR



Flexibility for making quick changes in air circuitry is now possible through two styles of panel mounted quick connectors.

Shown in the photo above, at middle left is a model with female 10-32 port at rear to accommodate metal or flexible tube fittings. At middle right is a connector provided with female 10-32 thread at the rear. When front portion of the coupler is disconnected, valve in the rear portion of the unit stops air flow.

At bottom right is a connector with 10-32 male thread for clamp mounting.

At top center is a miniature air valve. These valves are available in 2, 3 and 4-way styles for push-button or cam follower operation.

Clippard Instrument Co., 7390 Colerain Rd., Cincinnati 39, Ohio.

Use postpaid card. Circle No. 44

CARRIAGE BOLTS MEET HI STRESS REQUIREMENTS

Carriage bolts having a tensile strength of over 130,000 psi have been developed to meet the requirements of high stress conditions.

Usually found in such applications as conveyors, textile machinery, recreational equipment, marine applications and power equipment, the strength of

assembly and fastener engineering

JANUARY, 1961
(Not valid after March 31, 1961)

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What article in this issue interested you most?_____

What subjects would you like to see published in future issues?_____

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assembly and fastener engineering

JANUARY, 1961
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the bolts is due to the use of quality high-carbon steel, triple heated to give maximum strength, toughness and durability.

The bolts are impregnated with a rust inhibitor.

Premier Industrial Corp., 4415 Euclid Ave., Cleveland 3, Ohio.

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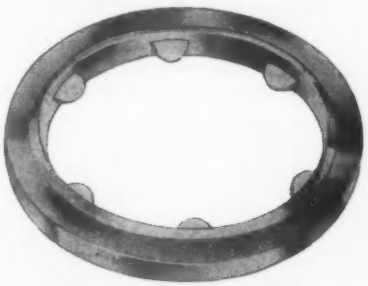
CAPTIVE SEALING WASHER MADE OF NYLON



Suitable for applications to 200 psi working pressure, a nylon captive sealing washer for screwed assemblies embodies flexible tongues on the interior diameter of the seal. Washer is pushed over the screw threads and the tongues spring into the undercut or screw thread to retain the washer when plug or bolt is removed from its fitting. Bolts and washer can be preassembled and stored without risk of becoming separated.

V. P. Black and Associates, 4832 Philadelphia Dr., Dayton 5, Ohio.

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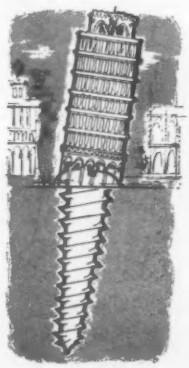
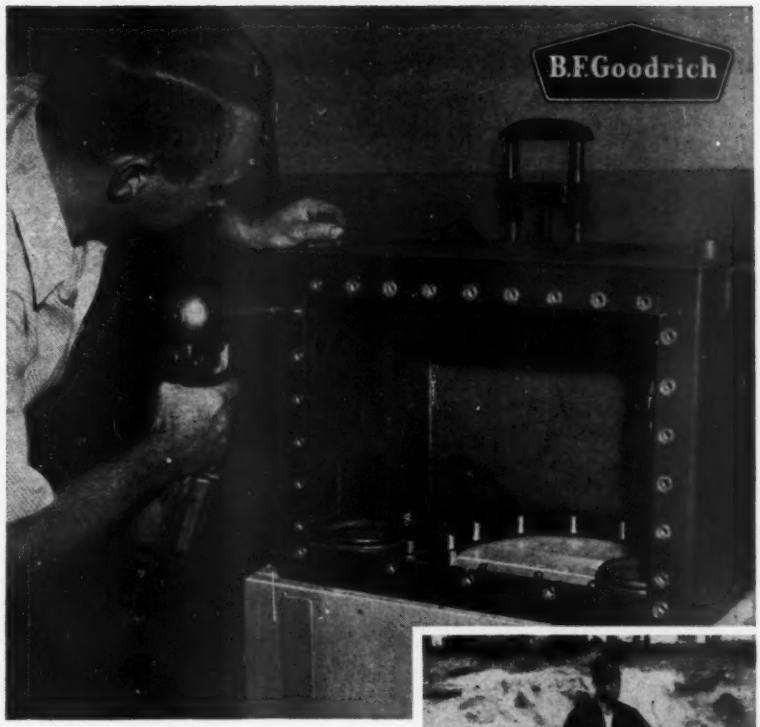
REVERSE CONE BOLT FOR CONCRETE

Based on the reverse cone principle, installation of a rod hanger or tie wire type expansion bolt is easily made. By drilling into concrete or other nonfrangible material, a hole of desired depth; the expansion bolt is inserted



The fastener engineer's solution to the leaning tower of Pisa. (See page 46).



RIVNUTS® streamline tank design; eliminate damage to product

This oil reservoir, fabricated by Stolper Steel Corporation, Menomonee Falls, Wisconsin, for a husky new Allis-Chalmers tractor-shovel, requires removable cover plates. This is accomplished with flush-mounted RIVNUTS and threaded bolts.

With RIVNUTS, all possible damage is eliminated, since the RIVNUTS project inside the tank. Installation is simple: holes drilled and countersunk, RIVNUTS upset with a heading tool. Flush installation permits obtaining a liquid-tight joint without grinding.

RIVNUTS are the only one-piece blind rivets with internal threads. If you'd like recommendations on a specific fastening problem, please send a print of your part. For descriptive bulletin, see Sweet's Product Design File, or write *Dept. AE-1, B.F.Goodrich Aviation Products, a division of The B.F.Goodrich Company, Akron, Ohio.*

B.F.Goodrich Rivnuts

Use postpaid card. Circle No. 249

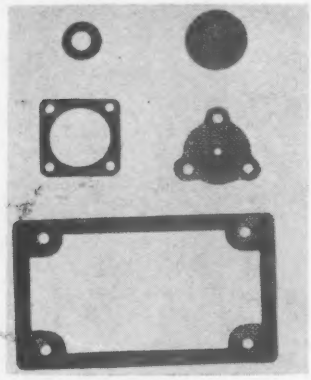
by hand. Once in place, the greater the strain, the tighter the bolt.

The bolts are made in a variety of sizes and available in all ferrous and non-ferrous metals.

Wej-it Expansion Bolt Co., Inc., Kingston, N.Y.

Use postpaid card. Circle No. 47

HIGH TEMP GASKET CONDUCTS AND SHIELDS



High temperature conductive and shielding gasket material, extends the temperature range from 500° F to minus 65° F. It is fabricated in any size or shape gasket, seal, shim, ring, etc., or supplied in sheets.

It was specially developed to prevent radio frequency energy from escaping at joints in closed containers with RF emitting apparatus, while also providing positive air and fluid sealing. It is available in two thicknesses, .016" and .020"; also by the yard in 8" widths or to specially cut gaskets.

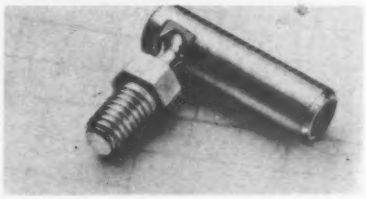
Its electrical properties provide a necessary conductive material between two metal surfaces, to allow the flow of electrical current while restricting or filtering any induced radio frequency.

It has applications in connection with wave guide equipment, ignition harnesses, X-ray equipment, and shielding between magnetos and their bases.

Auburn Manufacturing Co., Middletown, Conn.

Use postpaid card. Circle No. 48

MINIATURE JOINT AIDS PRECISION MANUFACTURE



Ball joints which are some of the smallest made for precision production in quantity have a shell only 27/32" long, ¼" in diameter. The ball screw is ⅝" long to the ball center, with ¼" hex wrenching flats and 10-32 thread. Female threads in the tapped hole of the shell run from No. 4 to No. 10.

The assembly is designed to give full freedom of movement to the ball. The entire unit is cadmium plated.

Type FM was especially developed for use in carburetor and governor controls for small gasoline engines and many electromechanical linkages.

It is useful for miniaturized servo-control systems, such as those used in missiles.

J. J. Tourek Manufacturing Co., 1901 S. Kilbourn Ave., Chicago 23, Ill.

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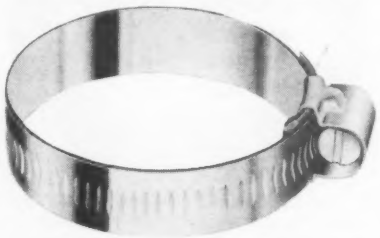
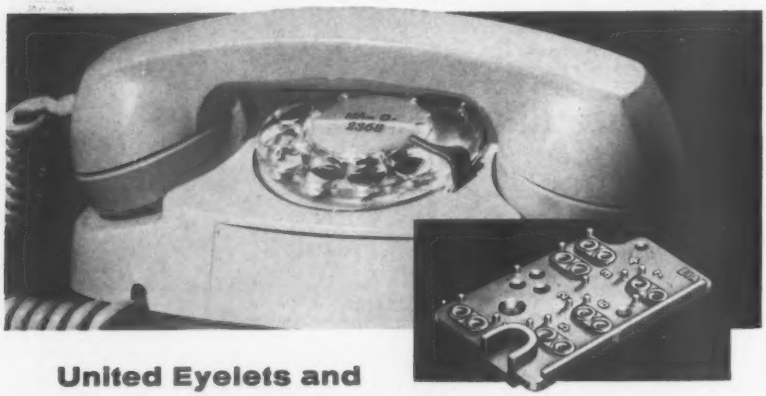
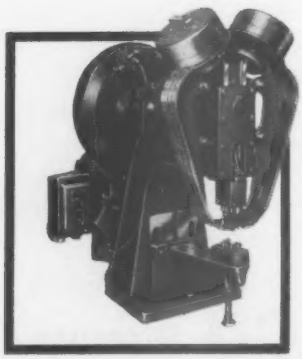
HOSE CLAMP PREVENTS EXTRUSION AND SCUFFING



A clamp for hose or other general industrial applications now being marketed is unlike old style worm-drive clamps. It has no perforations through the band to cause extrusion or scuffing of rubber. The steel screw engages on coined threads. Manufactured to prevent snapping open or



United Eyelets and Eyeleting Machines Keep this Princess on Constant Call



The new Princess telephone — a product of the Western Electric Company — is an achievement in communication design INSIDE as well as out, thanks in part to a United Eyeleting Machine that automatically feeds and sets six twin United Eyelets in a plastic insulating terminal board no bigger than a cigarette lighter.

Accurate alignment of the setting bar and an especially rigid frame — unique with the Model F United Eyeleting Machine — brings uniform pressure to bear on all six twin United Eyelets scattered over a broad pattern range.

If you want faster production using greatly simplified setups of multiple mechanisms plus absolute reliability in multiple eyelet patterns, call or write your nearest United sales office.

United

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jogging loose, the clamp can be removed easily if required. It also provides uniform clamping pressure and will not distort thin wall tubing.

Wide diameter adjustment is possible. Another feature is the unusual band take-up which is directed away from the fastening side of housing to eliminate interference during assembly. The deep slotted steel screw is encased in the housing to allow easy, positive screwdriver engagement.

The hose clamp is available in a wide range of sizes and in a choice of materials.

Marman Division, Aeroquip Corp., 11214 Exposition Blvd., Los Angeles 64, California.

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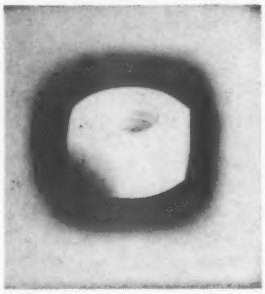
NYLON MACHINE SCREW NUT ADDED TO COMPANY LINE



A new nylon hex machine screw nut is added to a line of plastic fasteners. The new nut is offered in a range of sizes from 2-56, to ¼-28. The nut is double chamfered and double countersunk for automatic feeding.

Nylogrip Products, 570 Pleasant St., Watertown 72, Mass.

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Top ranking manufacturer needs—trainees and tech. representatives. Excellent opportunity for engineering graduates willing to relocate. Sales experience preferred; top remuneration; also need engineer with considerable cold header, thread roller and trimming experience for research and development. Replies confidential.

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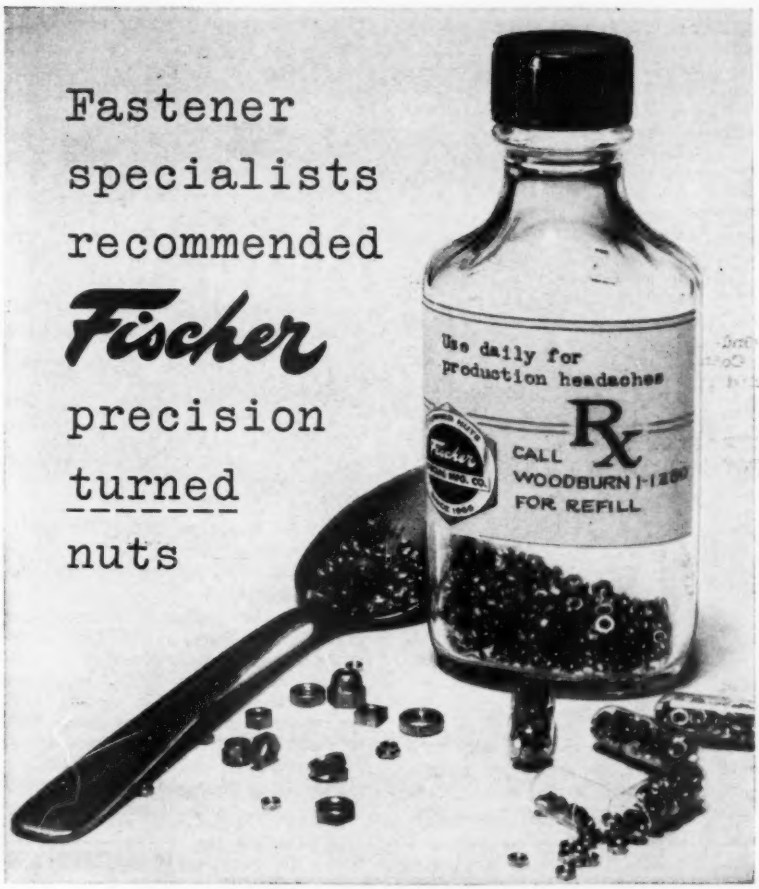
Answer to problem on pg. 60.
If the conclusion were not valid, then every tree would have a different number of leaves; and you would run out of leaves before you ran out of trees. It's valid.



to cure fastening and assembly headaches in miniaturized equipment!

Assembly operations for conventional size electrical and electronic equipment frequently are difficult, painstaking, time-consuming. *But when miniature components are involved, fastening problems can become extremely critical.* That is why maximum accuracy and uniformity are absolutely necessary in fasteners used in miniature assemblies.

Fischer . . . the leading producer of precision turned nuts . . . has paced miniaturization trends by establishing a high-production capability for miniature brass nuts. Ranging in size from 1/8" x 3/64", with standard or special threads from No. "0", these tiny nuts are solving fastening problems in all types of precision instruments and equipment.

If you require extreme accuracy . . . and want on-schedule deliveries at competitive prices . . . let Fischer quote your next miniature nut order.

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FISCHER SPECIAL MFG. CO.
496 Morgan St. • Cincinnati 6, Ohio

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THERMAL CURING ADHESIVE BONDS RUBBER TO METALS

An adhesive system for bonding silicone rubber to itself, or to glass, is also used for bonding rubber to metal, plastics and ceramics with the aid of a metal primer.

Improved silicone rubber thermal curing cement with an effective temperature range from minus 100° to plus 500° F, shows bond strength varying from 8 to 15 psi peel strength.

The new cement offers advantages of better handling, quicker curing and less sensitivity to adverse conditions of bonding.

Connecticut Hard Rubber Co., 407 East St., New Haven 9, Conn.

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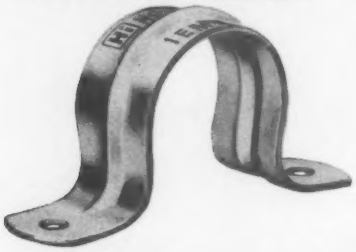
STRAP SNAPS ON FOR EASY INSTALLATION



Installation of pipe, thinwall and rigid conduit is simplified by using a semi-spring steel strap, which snaps on the conduit. The strap snaps on with a light press of the thumb, and can be easily pushed to either side for positioning. The snap-on feature eliminates fumbling and dropping and makes difficult installations easier, particularly overhead and hard to reach jobs. All straps are zinc coated, and come in sizes from ½" to 2" for EMT and other thinwalls. For rigid conduit and pipe, sizes are available to 4".

Holub Industries Inc., Sycamore, Ill.

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LEAK PROOF FITTINGS MADE FOR SMALL DIAMETER TUBES

A tube and pipe fitting for small diameter sizes from ⅛" to 1" od tube is an adaptation of standard Conoseal sealing principles.

Designed to withstand extreme low or high temperatures and high pressures of vacuum where leak-proof sealing is a requirement, this all metal fitting assures dependable sealing with temperatures ranging from minus 450° to plus 1500° F and pressures up to 16,000 psig.

The union fitting is well suited for joining critical pneumatic, hydraulic or fuel lines, cooling and heat transfer lines and pressure or vacuum lines.

Aeroquip Corp., Marman Division, 11214 Exposition Blvd., Los Angeles 64, California.

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WATER-RESISTANT ADHESIVE COATS AND PROTECTS LABELS

A crystal-clear water-resistant label cement and coating will adhere labels to metal, wood, corrugated board and other materials and can be coated over the labels also to protect them from mildew, water and other elements.

It can be applied by brush, roller or flow gun and dries rapidly to form a water and scuff-resistant coating on all label stocks. Dirt, smudges and other foreign matter on labels can be wiped clean, when coated with the adhesive.

Adhesive Products Corp., 1660 Boone Ave., New York 60, N.Y.

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HOUSING CONTACT

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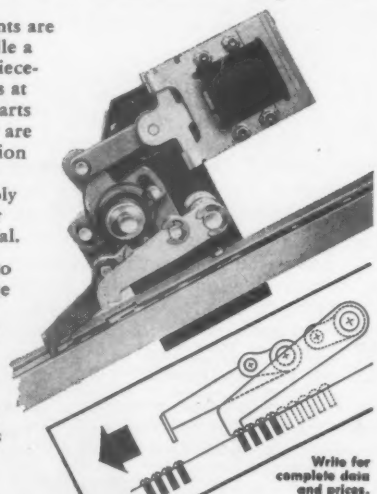
You won't need to experiment. These standard units save engineering and construction time and have the important advantage of replacement parts being available from stock.



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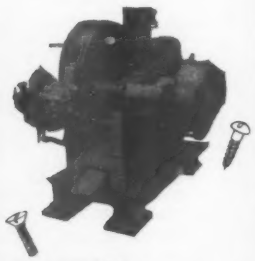

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dates easy-to-insert, easy-to-remove taper pins.

The connector will mount all .010-.055 printed circuit cards. The receptacles will receive the series 53 taper pin line, including both the pre-insulated and formed types. It is designed to permit 500 insertions and removals of the printed circuit card without damage to foil pads.

The taper-in connector has 22 contact positions, with contacts commoned for multiple-wire use. Length of the block is 4.281", with .156" center to center spacing laterally between contacts.

AMP Incorporated, Harrisburg, Pa.

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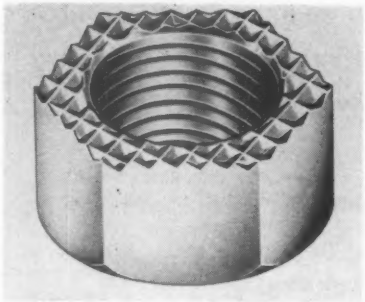
WAFFLE FACE LOCKNUT FOR SLOTTED ANGLE USE



A new waffle face locknut used extensively in steel shelving and slotted angle applications is produced by a cold headed process. It is available in all commercial sizes in steel, brass, aluminum and stainless steel in all finishes.

Jacobson Nut Mfg. Corp., Box 177, Kenilworth, New Jersey.

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An electrical fixture hanger for surface mounting electrical ceiling fixtures and junction boxes from T bar grid systems, called Zip Clamp, is a two piece metal clip that is easily locked in place on the T bar and the fixture then securely attached by tightening the wing nut. No screws, bolts or special tools are required to perform this one-man operation.

The clamp eliminates the use of U-bolts, or the drilling of holes and permits assembly without removing any of the ceiling pieces.

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William H. Hall Co., Windsor Locks, Connecticut.

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To receive your copy of any literature reviewed here, use the postpaid card opposite page 66.

SILVER BRAZING HANDBOOK

Pocket-sized booklet covers highlights of phases of silver brazing. Included in the 46-page booklet are charts for selections of fluxes, cross reference specification chart, a weight conversion chart, and thermal expansion of metals.

American Platinum and Silver Division, Englehard Industries, 231 New Jersey Railroad Ave., Newark, N.J.

Use postpaid card. Circle No. 60

BEADED CHAIN DATA

A 4 page folder on beaded chain and small swaged parts includes description and technical specifications as to sizes, metal, finishes and lengths of standard hollow beaded chain and special beaded chain with sections on couplings, rings, splicing links, pendants, sleeves and miscellaneous attachments. Auto-Swage Products, Inc., Canal St., Shelton, Conn.

Use postpaid card. Circle No. 61

AUTOMATIC PARTS FEEDERS

Vibratory parts feeders and elevating hopper feeders are the subject of a four-page descriptive folder. Describing the various machining applications of the parts feeders, special machinery is also shown. Production Feeder Corp., 3130 Johnnycake Ridge Rd., Mentor, Ohio.

Use postpaid card. Circle No. 62

CLAMP DESIGN CATALOG

Product information for line of industrial band clamps, hose clamps, couplings, etc., for all types of applications, is described in 44-page catalog No. 803. Compiled for design engineers, the dimensional operating data is also given. Aeroquip Corp., Marman Division, 11214 Exposition Blvd., Los Angeles 64, Calif.

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ELECTROPLATING PROCESSES

Two-color, 24-page bulletin EP-102 gives a brief description of eighteen electroplating processes which include the latest nickel semi-bright process that can be continuously carbon treated and the super bright, super-high-leveling bright nickel bath.

An illustrated description of the laboratory, testing and field services available to customers is included. Hanson-Van Winkle Munning Co., Church St., Matawan, N.J.

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CORROSION GUIDE

A 24-page "Corrosion Guide" for fasteners is of value to manufacturers and production engineers. Commonly used metals are tabulated to show approximate physical and mechanical properties and the suitability for manufacturing applications. There is an index for chemically equivalent specifications which cross-references these metals to ASTM, military and Federal specifications. H. M. Harper Co., 8200 Lehigh Ave., Morton Grove, Ill.

Use postpaid card. Circle No. 65

PORTABLE AIR TOOLS

Technical data on the complete line of air assembly tools, power motors and accessories, including a number of products introduced within the last nine months, is offered in detail in a 96-page Catalog 64. Convenient grouping of the contents in nine sections, with edge markers on all pages, offers easy reference to each section. Included are listings and line drawings with tabulated dimensions for self-feed drilling units and air hoists. Screwdrivers, nut runners and impact wrenches are specified. The Aro Equipment Corp., Bryan, Ohio.

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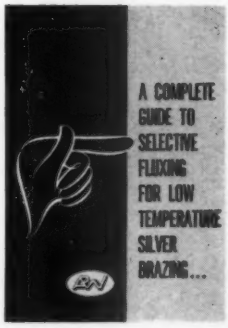
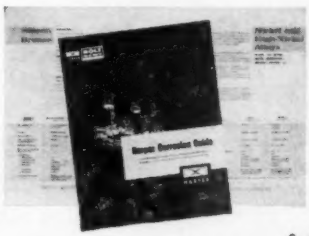


See 60



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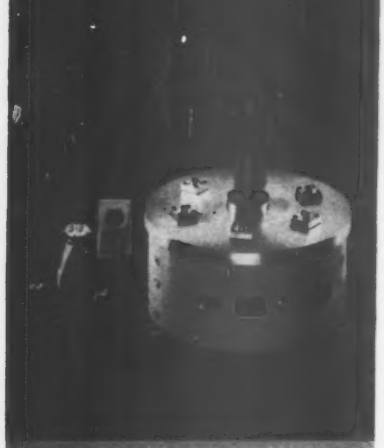
See 66

How many ways can the all-electric ELECTROTABLE increase your production ?



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Please send me information about the Series 3 Black & Webster all-electric indexing table which:

1. automatically positions work within ±.001"
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3. accommodates as many as 12 stations at speeds to 48 indices per minute
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WELDER SPECIFICATIONS

Operating features, construction, details and application information on a trackless carriage for semi-automatic welder are described in Bulletin 5205.2. Lincoln Electric Co., 22081 St. Clair Ave., Cleveland 17, Ohio.

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TOGGLE CLAMPS

The full line of De-Sta-Co toggle clamps, for both general purpose and special use, are presented in a new 36-page Catalog 77. The colorful publication is designed as a job-aid for designers, production engineers, and purchasing agents. It is sectionalized for speedy location of type and size of clamp wanted. Detroit Stamping Co., 330 Midland Ave., Detroit 3, Michigan.

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ADHESIVE USE CATALOG

A 12-page, two color, catalog A-ZBD-102-JR containing 8 fold-out tables lists the uses, characteristics and general properties of over 170 different adhesives, coatings and sealers.

Designed to help select the proper adhesive, coating or sealer for a specific application a cross reference index, included in the catalog, lists over 200 different adhesive, coating and sealer applications and refers to the section of the catalog where a product will be found for each of these specific applications. G. W. Crain Adhesive, Coating and Sealers Div., Minnesota Mining and Mfg. Co., 900 Bush Ave., St. Paul 6, Minnesota.

Use postpaid card. Circle No. 69

CONDUIT SNAP STRAPS

Semi-spring snap straps for thinwall, EMT, and rigid conduit are listed according to catalog number, size, and standard packaging on data sheet. Included also are prices per standard package. Holub Industries, Inc., 414 DeKalb Ave., Sycamore, Ill.

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SOLDERING IRONS

Complete line of production soldering irons for use on all electronic equipment, meters, and instruments is described in 4-page Bulletin GEC-1545. Special irons and transformers for soldering printed circuits, transistors, and miniature and subminiature components for aircraft and missile assemblies are included with listing of all ratings, prices, types of renewal tips. Also shows optional equipment available. General Electric Co., Schenectady 5, New York.

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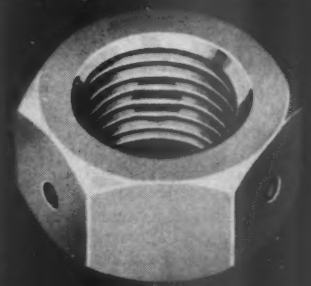
STOLLOCK NUT

U. S. Patent Numbers
2,754,871 2,859,459
Canadian Patent No. 537967



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- Nut body is not distorted
- Available in Grades "A" - "B" - "C" (Heat Treated)

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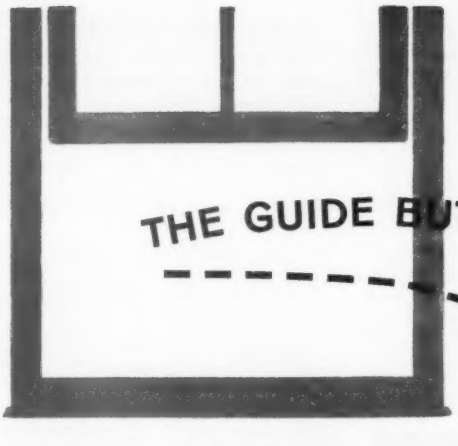
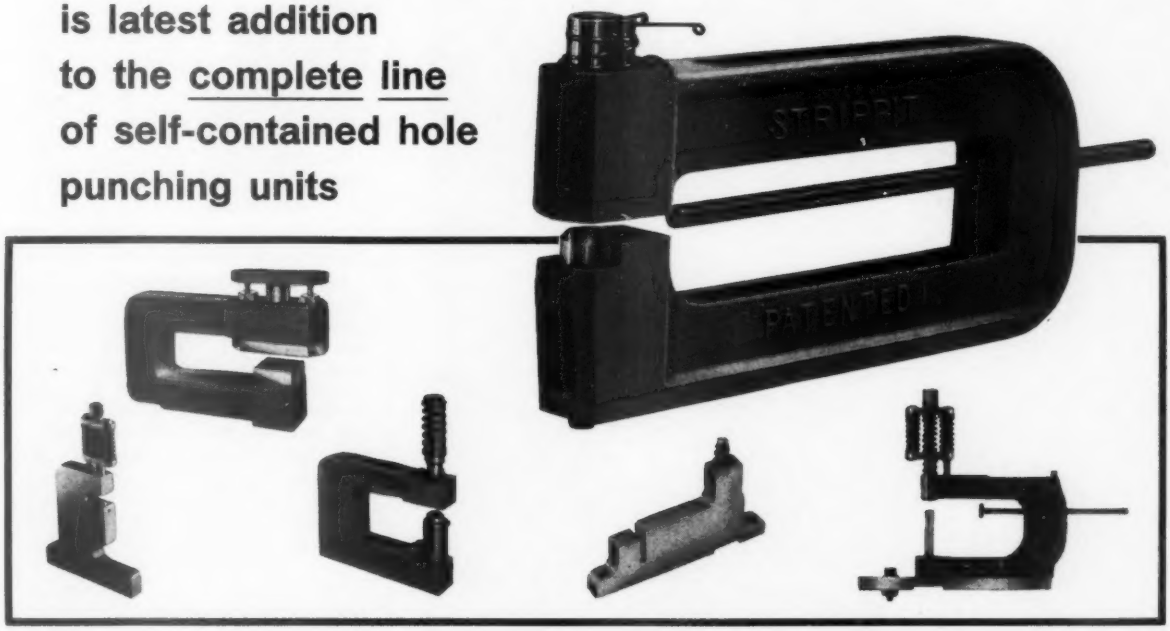


Wales STRIPPIT's new "BN" units have been designed for use *with or without* a guide button. Now, with this exclusive feature, only a punch and die (round or shaped) are required when you change from one hole size to another. For special applications and for optimum hole quality, the option of using a fitted or closed guide is still available.

THE GUIDE BUTTON GOES OUT THE WINDOW

NEW STRIPPIT "BN" SERIES

is latest addition to the complete line of self-contained hole punching units



Only STRIPPIT's "BN" units offer all these features:

- Use of fitted or closed guide button optional.
- All holders keyed for *both* round or shaped punches and dies.
- Self-storing keys supplied with each holder.
- Streamlined holder permits punching closer to leg of formed flanges and angles.
- New die section design permits easy removal and rotation of die without removing holder from set-up and retains the advantages and strength of one-piece construction.
- New threaded gage rod positions work more accurately and positively.
- All units, including ¾" unit, have hold-down slots for easier mounting.
- New stripping guide slips out quickly and easily without taking off retainer clip.
- One-piece oil hardened tool steel punches.
- Series expanded to include maximum hole size of 3½" in 10 gauge material.

WALES **STRIPPIT** INC.

A UNIT OF HOUDAILLE INDUSTRIES, INC.

241 Buell Road • Akron, New York

In Canada: Strippit Tool & Machine Company, Brampton, Ontario
In Continental Europe: Raskin S. A., Lausanne, Switzerland *In the British Isles: E. H. Jones (Machine Tools) Ltd., Hove, Sussex, England*

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PRICE SCHEDULE FOR NUTS

Prices, size, threading, of the Stollock and Marsden, self-locking nuts is available in catalog filler sheet. Zimmer-Lightbody Industries, Inc., 25645 Grand River Ave., Detroit 40, Michigan.

Use postpaid card. Circle No. 72

HORIZONTAL CONVEYORS

Five types of horizontal power conveyors are described and illustrated in a new 8-page, 2-color bulletin 19-1200. Product and installation photographs show APC conveyor in wheel and roller models, live-roller conveyors, belt-on-roller conveyors, table conveyors and turntable conveyors. The turntable conveyor is used in conjunction with other conveyor equipment to make directional changes in minimum floor space. Specifications are included for all types of conveyors discussed. The Rapids-Standard Co., Inc., 342 Rapistan Bldg., Grand Rapids 2, Mich.

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SOLDERING TIPS

Anti-corrosion, anti-freezing soldering tips having a 15% higher conductivity, are described in catalog filler sheet. Available sizes and shapes are also given. Hexacon Electric Co., 161 W. Clay Ave., Roselle Park, N.J.

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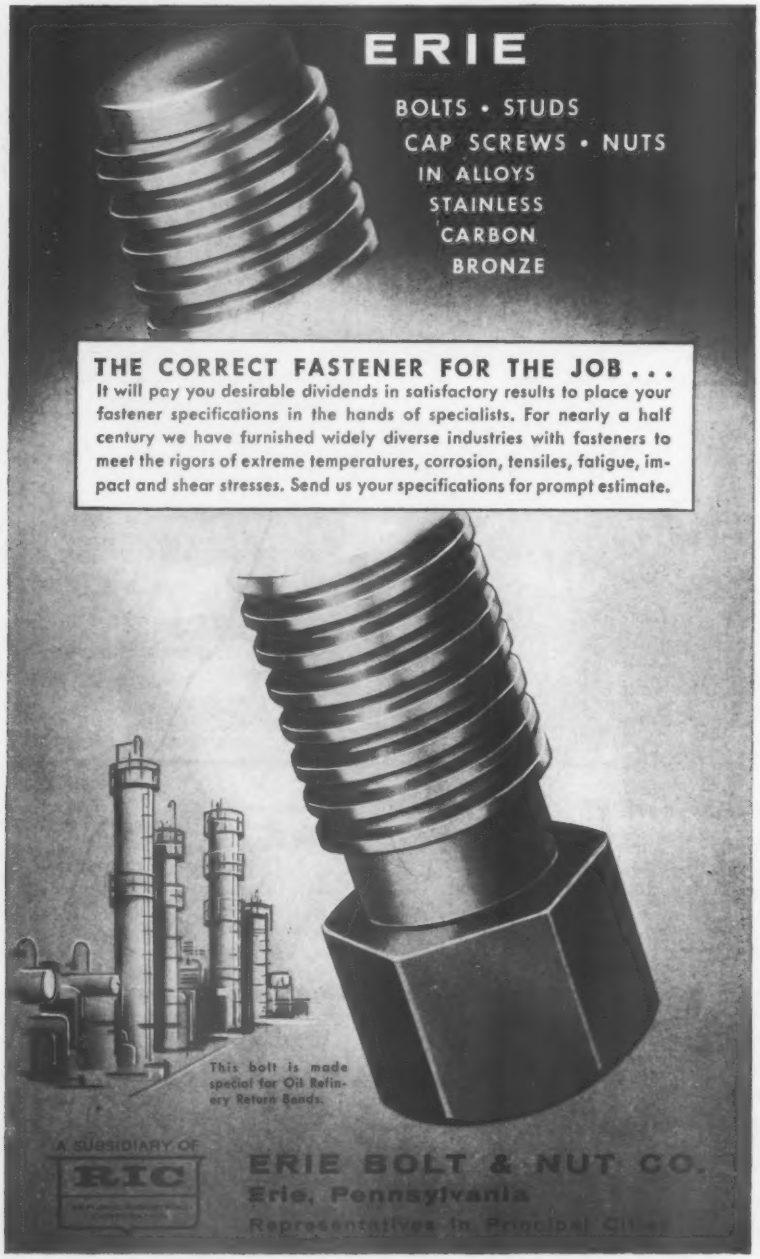
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MINIATURE HAND TOOLS

Midget pliers, cutters and other hand tools for use in assembling miniature electronic products, as well as for working in confined places, are included in the latest Utica hand tool catalog. All tools described are precision, finely finished tools. Utica Drop Forge & Tool Division, Kelsey-Hayes Co., Utica 4, New York.

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ENGINEERING SERVICES

A broad range of design and engineering services, along with some unusual services to aid management and manufacturing, are detailed in a new 16-page brochure. Technical publication and graphic illustration services also are described. Modern Engineering Service Co., PO Box 1007, Berkley, Michigan.

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HARDNESS TESTER CATALOG

Anyone who wishes to select hardness testing equipment will find his choice much easier if he has a copy of catalog RT-60. In addition to containing information on the principle of the Rockwell hardness test and of microhardness testing this catalog illustrates and describes microhardness testers.

It also illustrates and describes several models designed for specific uses. Wilson Mechanical Instrument Div., American Chain and Cable Co., Inc., 230 Park Ave., New York 17, N.Y.

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METAL STITCHING

Application of metal stitching to steel, copper, aluminum, rubber, plastics and other similar materials is shown in eight page information folder. Also included are photos and descriptions of various production metal stitching models. Bostitch, 16 Briggs Dr., East Greenwich, R.I.

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CONVERSION FACTORS CHART

Useful to engineers and other executives is a reference table in wall chart form. Common conversions such as inches to centimeter or watts to horsepower, as well as less easily located conversions such as; atmospheres to Kgs/sq.cm; cm/sec to mph; cu. ft. to liters; microns to meters are included. Precision Equipment Co., 4411 E. Ravenswood Ave., Chicago 40, Ill.

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LAYOUT MACHINES

Layout drilling machines in various models from the standard machine to automatic positioning type machines, are listed in catalog No. 160. Included also is a specification chart for the various machines. Jackson Fotsch Co., 7350 W. Lawrence Ave., Chicago 31, Illinois.

Use postpaid card. Circle No. 80

IMPACT POWER TOOL

Compact, hand held, impact power tool is described in informative folder. Photos showing some applications and specifications for performance at 90 psi air pressure are also given. Ingersoll-Rand, 11 Broadway, New York 4, N.Y.

Use postpaid card. Circle No. 82

AXIAL-LEAD HANDLING UNIT

Four-page brochure describes and illustrates an orienting and testing unit designed for use with lead straightening and taping machines. For manufacturers using axial-lead components, it provides for 100% inspection of incoming bulk components. A production rate of 3500 parts per hour is considered normal. Electronic Equipment Sales, Universal Instruments Corp., 139 E. St., Binghamton, N.Y.

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SPRING GENERATOR

The making of springs in a single operation is shown in a series of photographs in informative bulletin. Included also are specifications of the unit. Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.

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PLANNED RETOOLING GUIDE

Portable power tools may be producing only 60% of rated output, according to a 28-page report. Planned annual retooling can increase output of screw driving, grinding, nut running, drilling and similar operations. The guidebook offers basic formulas for computing the dividend on payroll dollars possible by planned annual retooling. Ingersoll Rand Co., 11 Broadway, New York 4, N.Y.

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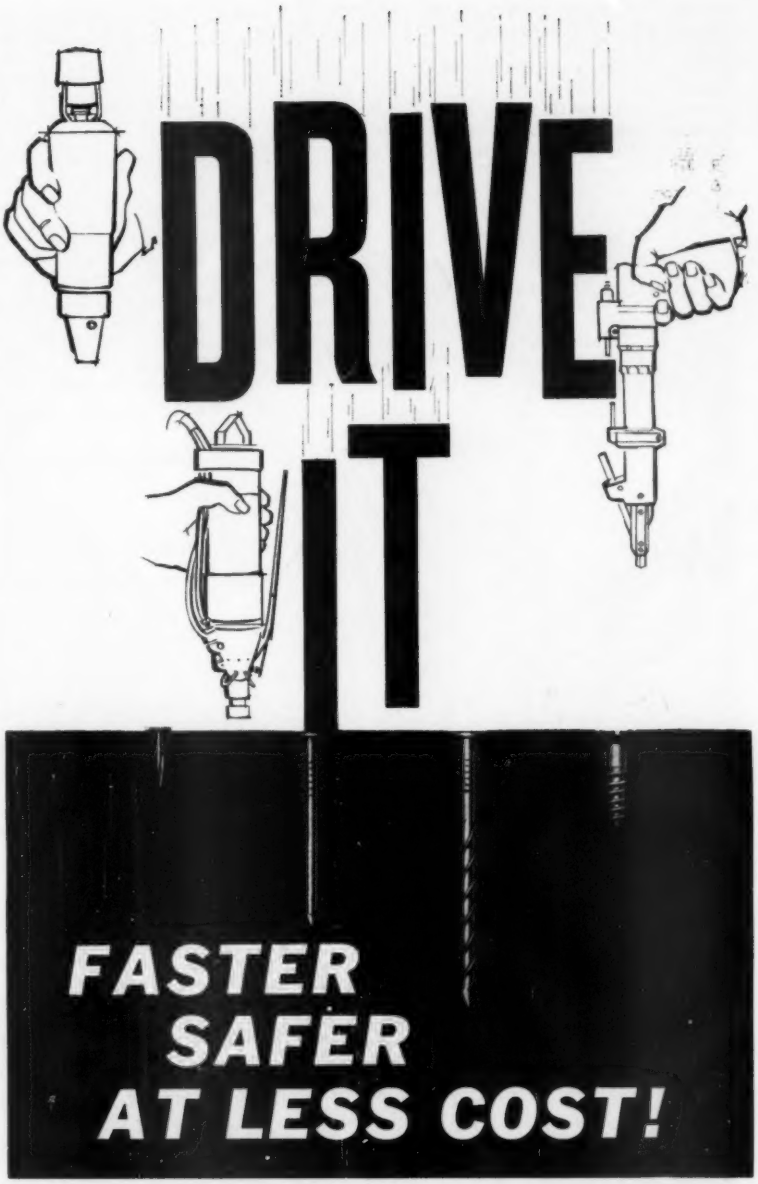

Now . . . a proven method just waiting to help you cut costs in fastening! If you use tacks, nails or screws, it's a good bet that POWASERT automatic fastening can drive them faster, safer and at far less cost.

POWASERT equipment automatically feeds and drives — makes tacking, nailing or screwdriving an easy one-hand operation. Tacks at 300/minute, nails at 225/minute, screws at 60/minute, helps you boost production and improve product quality. POWASERT equipment is thoroughly engineered, foolproof, light and easy to handle. It is completely portable.

Send for the POWASERT Folder . . . The entire line of POWASERT automatic fastening equipment is described in an 8-page brochure. Please let us send you a copy. Your United Sales Engineer will be glad to demonstrate the equipment for you; or tell us your product and we'll send you facts and figures on similar applications. Call or write, today. United Shoe Machinery Corp., 140 Federal St., Boston, Mass.

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SOFT SEAM BONDING

High strength, solvent-resistant adhesive for bonding closed cell vinyl foam to itself or to a fabric is covered in three-page report. Preparation, application and specifications for the R 379-20 adhesive are given. Rubber & Asbestos Corp., 225 Belleville Ave., Bloomfield, N.J.

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BLACK LIGHT INSPECTION

Contamination detection with black light is the subject of informative four-page folder. Application of black light inspection techniques in the electronics, aircraft, and missile fields is discussed. Also included is list of formulated fluorescent dyes and additives for black light inspection. Ultra-Violet Products Inc., Walnut Grove Ave., San Gabriel, Calif.

Use postpaid card. Circle No. 87

WIRE PROCESSING MACHINE

Wire processing machine capable of cutting and stripping lengths from 1" to 300' is described in four page data sheet. Included are specifications and a detailed photograph of the unit. Eubanks Engineering Co., 260 N. Allen Ave., Pasadena, Calif.

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...cut drill-countersinking costs up to 90%!

...when installing Nutplate and skin fasteners.

Tremendous time-saving and cost-cutting advantages make the Winslow Nutplate Drill Motor the most efficient and generally accepted method of installing Nutplate and skin fasteners. Here's how this portable tool operates: The expanding collet is inserted into the clearance hole to which the Nutplate is to be applied. The trigger is then pulled, causing the collet to expand and clamp the tool to the work. The drill-countersinks are then power-fed into the workpiece.

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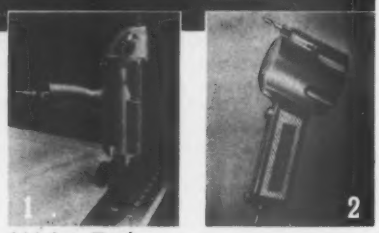

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Manufacturers of power hand tools and accessories for the nation's aircraft and manufacturing plants.

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SPECIAL EQUIPMENT

Capsule case histories of special equipment, to meet the requirements of the metal working industry, are contained in an 8-page bulletin, E60-1. Illustrated are resistance and arc welders, welding guns and stations, jigs and fixtures, mechanical handling equipment, automation systems and assembly presses. Brief details of machine design and methods are given along with the production rates and cost savings achieved. Kirkhof Manufacturing Co., 2450 Buchanan Ave., S.W., Grand Rapids 7, Michigan.

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DIAL FEED WELDERS

A 12-page brochure (8-213) describes dial feed mechanism for resistance welders. Included are drawings and photographs of the Geneva index mechanism and a graph showing recommended rate of indexing for various numbers of stations. Twenty-eight machine photographs and case histories outline: product, operation, production rate, etc., for these high production welders which are particularly suitable for assembly of smaller components. Automatic loading, unloading, inspection operations are illustrated. Taylor-Winfield Corp., 1048 Mahoning Ave., Warren, Ohio.

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JIG TRACING TEMPLATES

Component parts for jigs, fixtures and special machinery are described in catalog 31. Included are full scale tracing templates of jig and fixture components and over 300 clamping items. Northwestern Tools, Inc., 138 Hollier Ave., Dayton, 3, Ohio.

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BARREL FINISHING MACHINES

A four-page brochure on the vibratory barrel finishing machine includes specifications, data and illustrations of the company's newer models for deburring, deflashing, grinding, descaling, polishing, burnishing or drying of unfinished parts. Syntron Co., 820 Lexington Ave., Homer City, Pa.

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CAPTIVE SEALING WASHER

A nylon sealing washer, with flexible internal tongues which spring into the undercut or screw thread to retain the washer when bolt is removed from its fitting, is described in a data sheet. Also included is design information as to external, internal diameters, and thickness, for 14 different thread sizes. V. P. Black and Associates, 4832 Philadelphia Drive, Dayton 5, Ohio.

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LOCKBOLTS

Controlled preload through built-in torque control is the feature of a lock bolt for high strength and high temperature applications. A four-page technical brochure details the Hi-Lok fastener which combines the features of a bolt and rivet. Power installation tooling is pictured. Tension-fatigue and residual-ultimate tension are charted. Hi-Shear Corp., 2600 W. 247th St., Torrance, Calif.

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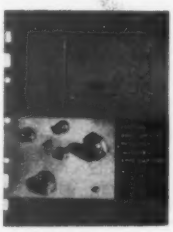

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SELF LOCKING NUTS

Up-dated review of self-locking standard nuts and clinch nuts is presented in a six-page bulletin 2339. Included is specification information for both light and heavy duty thin and full height locknuts; for the microsize series; for the 8-pitch series; and for both standard and microsize clinch nuts. Size range covers No. 0 through 2 inches in thread diameter. Materials are alloy steel, brass, stainless steel and aluminum—with a variety of platings and surface finishes available as indicated. A. Roesler, Box 1121, Standard Pressed Steel Co., Jenkintown, Pa.

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DESK-SIZED ANODIZER

Desk-sized electrolytic process unit designed to prepare hard-anodized samples in the lab for prototype or experimental work is described in a four-page folder. Basic components of the Model 500 are described in the bulletin. Allen Aircraft Products Inc., 4879 Newton Falls Rd., Ravenna, Ohio.

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MAGNIFYING LAMPS

Magnifying lamps, as well as other specialized bench lamps are listed and reviewed in 12-page booklet. Included also are installation, adjustment and cleaning and maintenance information. Luxo Lamp Corp., Dock St., Portchester, New York.

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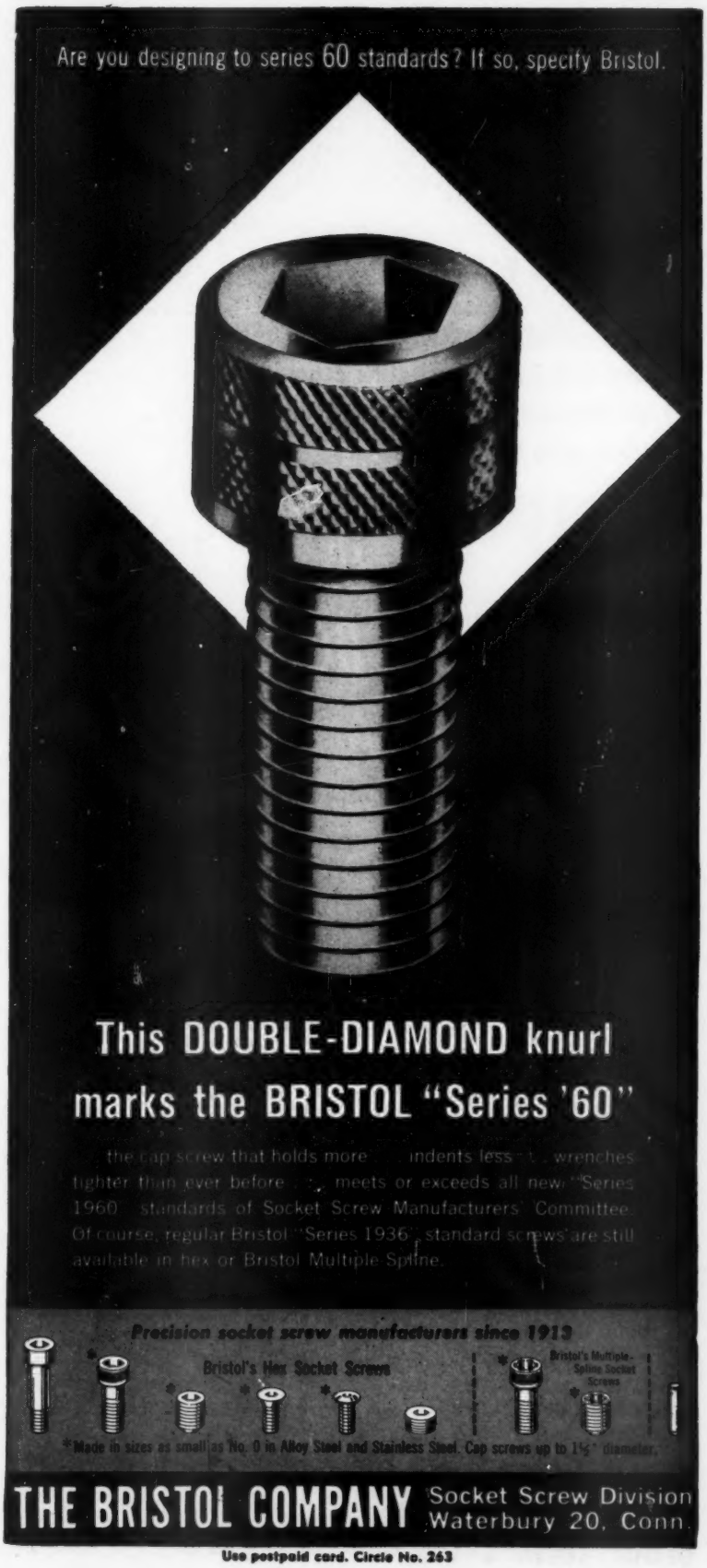
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This DOUBLE-DIAMOND knurl
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Precision socket screw manufacturers since 1913
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Bristol's Multiple-Spline Socket Screws
*Made in sizes as small as No. 0 in Alloy Steel and Stainless Steel. Cap screws up to 1½" diameter.
THE BRISTOL COMPANY
Socket Screw Division
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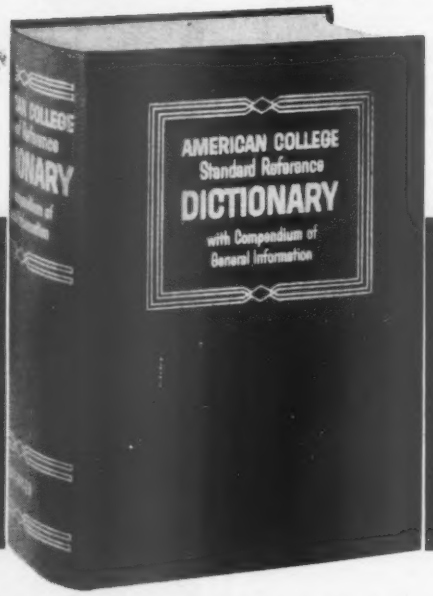

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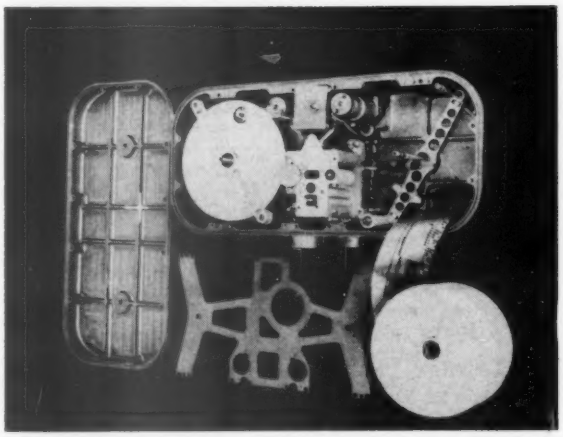
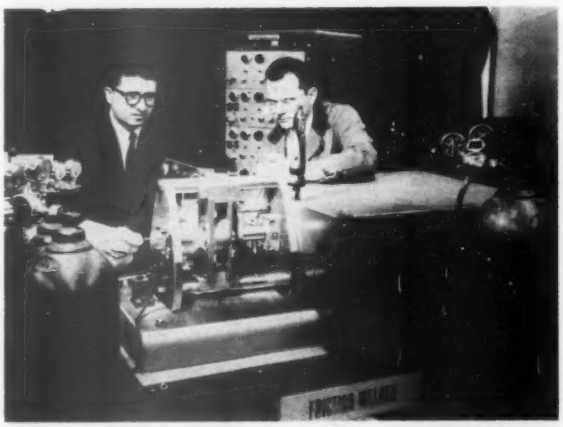
INDUSTRY MAKES NEWS



TAPE READERS aboard the Courier satellite are hermetically sealed in exceptionally small package—14 x 7½ x 4". They are bi-directional and have a storage capacity for over one year of operation.



AMF'S LABORATORY friction welder during the welding of high carbon steel is operated by Dr. M. B. Hollander, (l) and F. Camps-Campins, (r). The highly instrumental laboratory welder was used in the first intensive American study of friction welding.

OCTOBER FASTENER SHIPMENTS

October fastener shipments were 83% of the 1956-58 average, on a seasonally adjusted basis. While showing a 14 point decline from the September figure of 97%, taking an average for both months shows shipments to be 90% of base, which is near the average activity since April, 1960. Shipments for October 1960 were the same as those for October, 1959.

SATELLITE FEATURES PAPER TAPE READER

The messaging instrumentation serving the Courier communications satellite features the first use of paper tape readers. The satellite readers were built by Tally Register Corp., Seattle, Wash.

The readers aboard the satellite are hermetically sealed in an exceptionally small package, weighing only nine pounds. They are bi-directional and have a storage capacity sufficient for over one year of operation, on 500 feet of Mylar aluminum-foil tape.

To satisfy space and weight requirements, an available reader was redesigned and repackaged, reducing its size and weight by one half.

AMF REPORTS FRICTION WELDING STUDY

A study at the American Machine and Foundry Company's research laboratory has lead to a more refined explanation of the process of friction welding. Early explanations can be summarized as a variant of pressure welding. The weld is made during plastic deformation of the abutting surfaces.

Among the data contained in the new study was evidence that a layer of fluid metal is formed at the interface of the metals being welded by the friction process.

In the first intensive American laboratory study of friction welding, AMF researchers found that the subject had been under more intense study abroad in recent times, following the publication of a work by V. I. Vill (USSR) in 1957. Since then, about a dozen papers and summaries have been published in Russian, Polish and Czechoslavakian journals. Most of this early work could be charac-

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Top view of Hanscom-Tie is shown. Bottom is flat

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The Jack Nut cuts cost, speeds assembly, solves hitherto impossible fastening problems. Can be used as a rivet and/or blind fastener. It's versatile, easy to use and no special tools are needed.

The only blind fastener with threads which grips any material from 0" to 3/8" thick. Needs only 1/8" expansion space. Allows holes to be fashioned before, during or after fabrication. Hole size is not critical and special type of hole is not necessary.

Made of quality steel, cadmium-plated. Grips evenly on rough as well as smooth surfaces. Provides vibration-proof assembly. Weight-carrying capacity is limited in most cases only by strength of the material in which used.

EASY TO INSTALL

1 Insert Jack Nut into hole. Needs only 1/8" expansion space.

2 Run in screw to collapse spider anchor backing by exerting pull on thread.

3 Jack Nut now is installed and ready to receive attachment screw.

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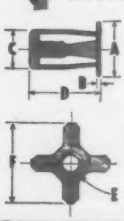
SPECIFICATIONS



CAT. NO.	A CAP DIA.	B CAP THICK.	C BODY DIA.	D O'ALL L'GTH.	E THREAD	F MAX. SPREAD
4-S, JN	15/32	3/64	9/32	9/16	6-32	43/64
4-L, JN	15/32	3/64	9/32	3/4	6-32	43/64
* 6-S, JN	17/32	1/16	3/8	11/16	10-24	25/32
** 8-S, JN	5/8	1/16	27/64	3/4	1/4"-20	13/16

S for 0" to 1/8"; L for 1/8" to 3/8"
*8-32 & 10-32 threads available
**10-24 & 12-24 threads available
NOTE: 4-S, JN & 6-S, JN also available in brass

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terized as pragmatic or "instinctive" explanations of the phenomena.

The American study investigated, derived and measured the parameters and machine requirements for friction welding such as: speeds of rotation; machine rigidity; time and weld cycle sequence; torque; pressure temperature; heat treatment; grain growth; metallurgy and weld geometry.

Using its laboratory machine, friction welding of a variety of materials including carbon, alloy and stainless steels, brass, aluminum, copper and zirconium were also studied.

The study was conducted by Dr. Milton B. Hollander head of the mechanics department of the laboratory. The laboratory will continue its friction welding studies in order to refine and elaborate its theories; refine its determination of parameters; and study the friction welding of dissimilar metals.

Meet Rudy Mate

He has joined the staff of Assembly and Fastener Engineering as Associate Editor. From time to time he will be out covering a story, attending conventions and symposiums, and we hope all of you will have an opportunity to meet him personally.

Rudy has had wide experience in the mechanical field, having previously held positions in the electronics and construction fields.

While serving in the electronics field, principally in an administrative capacity, his work there included job analysis and preparation of manuals.

His work in the construction industry included the requirements of considerable knowledge of component assemblies and fasteners, as well as technical analysis and writing.

He served in Europe with the Army Air Force during World War II as a radio operator and communications technician.

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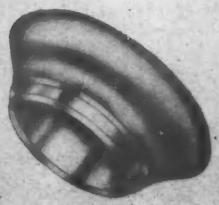

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make a positive seal up to 250°F and can be used with any standard fastener including tapping screws

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LOWER RATES FOR WASHERS AND GASKETS

A general reduction of 8.5% on less-than-carload shipments of such packing devices as washers and gaskets has been announced by Lifschultz Fast Freight.

Class 77½ now applies to these items moving in the Lifschultz service. Rates vary according to points of origin and destination.

AMERICAN SEALANTS OPENS NEW PLANT

The American Sealants Company has opened a new plant with adjoining sales and administrative offices in Newington, Connecticut, a suburb of Hartford.

LEE ADDS NEW SALES REPRESENTATIVES

The Lee Company, Old Saybrook, Conn., has appointed the following sales representatives: Earl E. Dyess, Fort Worth, Texas; Thomas W. Williams, Indianapolis, Ind.; George C. Milan, Baltimore, Md., and Frank Villiani, Dearborn, Mich.

APPOINTED MANAGER AT SYNTRON

J. W. Philippovic has been appointed manager of the automation and parts handling equipment department at Syntron Company, Homer City, Pa.

He will supervise research, development, production and sales of all Syntron automation equipment such as parts feeders, elevator feeders, assembly and packaging machines and placing devices.

Philippovic served as design engineer until moving to the Automation and Parts Feeder Department as divisional engineer in 1955—a post he held until his recent promotion.

COMPTROLLER OF GM ASSEMBLY DIVISION

Tyler H. Barrett has been appointed as comptroller of General Motors' Buick-Oldsmobile-Pontiac assembly division, with headquarters in Detroit.

The division assembles the passenger cars in six plants across the country.

Barrett, who has been resident comptroller of the division's Wilmington, Del. plant since February, 1958, succeeds H. Whitney Clapsaddle, who has been on special assignment prior to his retirement on January 1, 1961.

THE HISTORIC FLIGHT AND RECOVERY from the sea of a space capsule is studied after recovery by (l. to r.) E. Campbell, NASA Goddard Space Flight Center; Sam Urcis, Ryan Aerolab project manager for NERV; VAdm. C. L. Melson, First Fleet commander; Dr. John Naugle, program manager for the NERV project; and Capt. A. R. Olsen, skipper of the transport Paul Revere, which returned the nose cone to San Diego. An ARGO D-8 four-stage solid propellant rocket, developed and built for NASA by Ryan Aerolab of Pasadena, successfully boosted the Nuclear Emulsion Recovery Vehicle (NERV) to an altitude of about 1200 miles after launching from Naval Missile Facility, Pt. Arguello, California. Seamen aboard the Navy destroyer USS Rowan recovered the 83-pound General Electric capsule from the sea.

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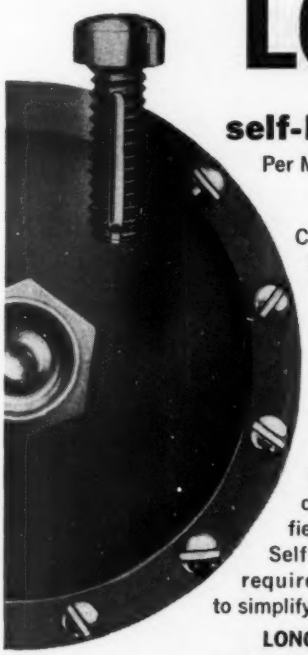

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Per MIL-F-18240

Critical **weights** and needless and costly man-hours of **assembly time** are being saved through the use of **LONG-LOK** Self-Locking Screws on pressure switches, motors, pumps, valves and other airborne accessories.

Many companies in the aircraft, missile and rocket fields are using **LONG-LOK** Self-Locking Screws per the requirements of MIL-F-18240 to simplify their assemblies.

LONG-LOK Self-Locking Screws are heat, vibration, shock and impact resistant. They are reuseable and can be head marked for self-lock identification per specification. Increased reliability of component and system is assured.

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EVERDUR
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STANDARD LOCK WASHER & MFG. CO., INC.
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MILFORD RIVET AND MACHINE NAMES CLARK

Milford Rivet and Machine Company, Milford Conn., has announced the appointment of D. Wheeler Clark as general sales manager. He will be responsible for general supervision of all plant and field sales staffs for both Milford rivets and riveting machines.

Since joining the company early last year as assistant to the president, Clark has been particularly active in developing inventory and production controls.

Clark is also a director of the Acme Shear Co., Bridgeport, Conn.

SAN FRANCISCO WAREHOUSE FOR RB&W

A new direct factory warehouse to service Bay area users of industrial fasteners has been opened in San Francisco by Russell, Burdsall and Ward Bolt and Nut Co.

The R B & W's regional sales office will also be at the warehouse location.

BAIRD MACHINE CO. HAS LEASING PLAN

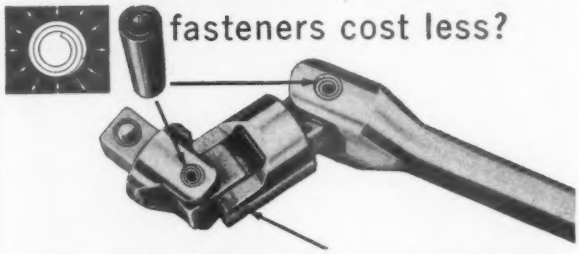
A program, enabling manufacturers to lease any of the complete line of automatic high production machinery made by the Baird Machine Co., Stratford, Conn., has been announced. A leasing arrangement has been established between the company and the Equitable Leasing Corp., of New York City.

The leasing arrangement, called "The Equilease Plan," was organized to fill the needs of commerce and industry for the long-term financing of productive assets through the medium of leasing. The plan enables a manufacturer to lease machinery on a monthly rental basis for a 60 month term.

Why do

SPIROL *the true spring* **PIN**

fasteners cost less?



1. 80% of spring pin applications only require Medium Duty SPIROL PINS, which cost less.
2. Even the Heavy Duty SPIROL PINS in this socket-wrench universal joint don't cost more than other types of spring pins.
3. Assembly costs are lowered with SPIROL PINS! Just drill the hole (plus and minus tolerances allowed only by SPIROL PIN) and drive the pins—automatically or by hand.
4. Medium and Light Duty SPIROL PINS replace more costly fasteners, even in materials where other spring pins cannot be used. Come in Miniature Diameters, too: 1/32" to .052".

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WELDING SESSION AT CONFERENCE

Welding in regard to plant maintenance and engineering will be discussed during a specialized welding session at the Plant Maintenance and Engineering Conference in Chicago on January 23, 1961.

Chairman of the welding session is Harry Schwartzbart, supervisor of welding research at the Armour Research Foundation. Orville T. Barnett of Armour Research will speak on "Welding filler materials useful in maintenance", and Willerd Schumbacker of Allis Chalmers will give an account of "Recent experiences with unusual maintenance welding jobs".

The conference, scheduled to run through January 26th at the International Amphitheater, will have the welding session at 7:30 in the evening on January 23rd.

SALES MANAGER AT ALLOYS UNLIMITED

Irwin Stelzer has been named sales manager for Alloys Unlimited Chemicals, Inc. of Long Island City. In his new position he will supervise sales and market research.

Before joining Alloys Unlimited Chemicals, Inc., Stelzer was a sales executive for United Mineral & Chemical Corp. Since the inception of the semiconductor industry, he has specialized in marketing solid state materials.

MIDWEST REP. FOR SNYDER CORPORATION

Neff, Kohlbusch and Bissell, Inc., Chicago, Ill., has been named the midwestern sales representative of Snyder, Corp., Detroit, Michigan. They will handle sales of Snyder special machine tools and automated machinery in Illinois, Iowa, Indiana, Minnesota and Wisconsin.

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No die charges
No blanking scrap losses

- No lead time needed for dies or exact strip.
- Use with induction, gas-air, furnace, or other heating methods.
- Available in EASY FLO and SILFOS — Copper, Bronze, and other alloys.
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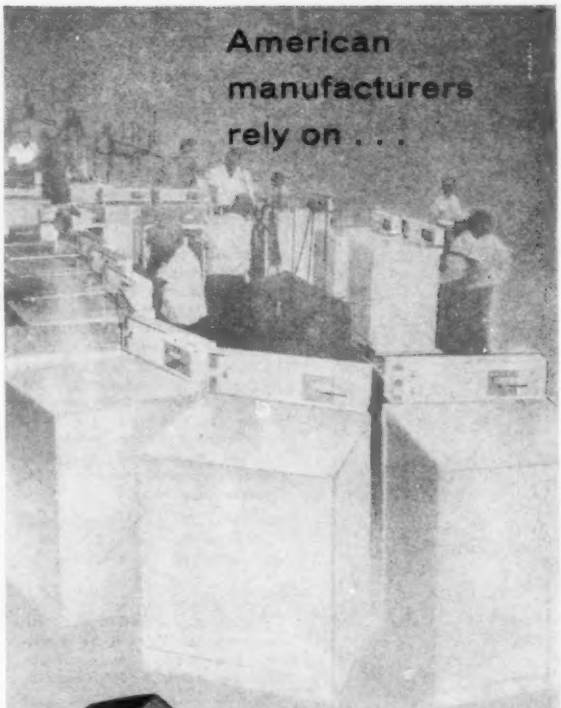

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National Lock offers superior engineering and design ability, plus extensive, up-to-date production facilities, to manufacturers in all phases of American industry. The broad knowledge gained in serving these varied customers can serve you, too. Look to National Lock when you need fasteners and decorative or functional hardware of the highest quality. Write today for full information.

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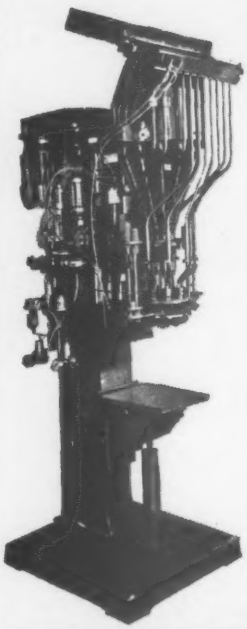
this machine will drive up to 10 screws at one time . . .



. . . reducing assembly costs and improving quality. Built for high production jobs where a fixed set up is practical, this multiple spindle screw driving machine automatically feeds screws from a hopper and drives them to a predetermined torque. Evenly distributed pressure eliminates stresses caused by driving home one screw at a time. A simple sliding fixture positions work pieces accurately.

Machine illustrated shows application of multiple spindle screwdriving to assembly of electric power drills.

Send a sample of your assembly and a list of your requirements. We will be happy to show you how multiple spindle screw driving can be applied to your job.

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ARMSTRONG WRENCHES

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An ARMSTRONG Wrench feels right—is balanced. It goes over nuts or screw heads easily, grips firmly without sloppiness, won't round corners—because openings are carefully machined to correct sizes. It's safe, strong beyond need without clumsy bulk—because of superior design and selected steels, heat treated to proper degree of hardness and tensile strength. It's quality finished, ARMALOY (alloy steel) Wrenches in chrome plate with heads buffed; HI-TEN (carbon steel) Wrenches in baked-on gray enamel with heads ground bright . . . all plainly marked for size. All are uniformly excellent tools manufactured under strict quality control, by modern methods, with modern equipment in a modern tool plant . . . 1537 different industrial sizes and types —single wrenches, or sets in metal cases, boxes or rolls . . . each a quality tool. Armstrong Wrenches are "Fine tools that encourage good work."

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PROMOTIONS AT ELASTIC STOP NUT

LALLY

SORENSON

LINCK

Elastic Stop Nut Corp., has announced the appointment of Desmond E. Lally, director of marketing. Succeeding him as general sales manager is Donald B. Sorenson. Bruce F. Linck will serve as assistant director of marketing while continuing present responsibilities as advertising and sales promotion manager.

SERVICE TOOLS INST. RE-ELECTS McMULLEN

Turner A. McMullen, VP and general manager of the Herbrand Division, Bingham Herbrand Corp., was unanimously re-elected to a second term as president of the Service Tools Institute at a recent meeting of the institute in New York City.

McMullen, a former management consultant, has been a B-H vice-president for six years. He has been active in America's hand tool industry for many years.

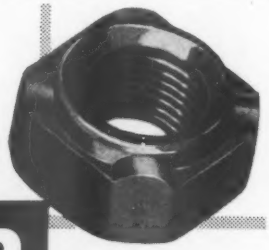
Also re-elected at the recent meeting was STI vice-president Marvin S. Bandoli, who is senior VP of Pendleton Tool Industries.

The Service Tools Institute is a national trade association composed of this country's manufacturers of mechanics' hand service tools.

INDIANA SET SCREW APPOINTS S.M.

Charles R. Buening has been appointed sales manager of the Indiana Cap and Set Screw Co. Their plant is located in Franklin Park, Ill.

fast . . .
positive . . .
economical



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COLD HEAD PROCESS

Decker Weld-Nuts are manufactured to meet your demands for a better, faster, more positive method of parts assembly. Like all Decker Industrial Fasteners, Weld-Nuts are produced via the cold-head process to assure a uniform quality and exceptional economy. Decker Weld-Nuts are available in three basic types and a broad range of sizes to meet every conceivable need.

Study your production applications now and see for yourself the many operations where Weld-Nuts could save your production time and dollars.

Then . . . write for sample fasteners, as well as your copy of Decker's new illustrated Industrial Fastener catalog!

OTHER DECKER INDUSTRIAL FASTENERS

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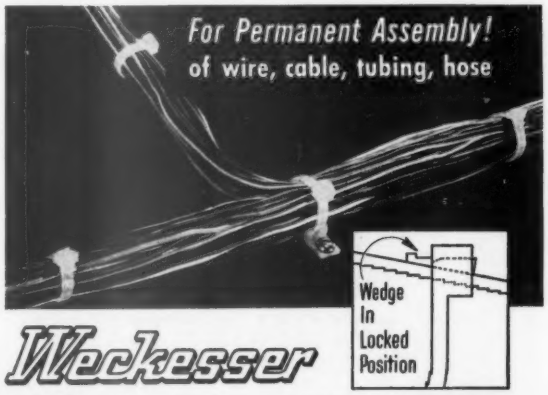
FIRST DAY SPEAKERS at Fastener Symposium held in November at the University of Wisconsin Engineering Institute, Madison, Wisc. Speakers left to right, are Bruce Olsen, Standard Screw Co.; Vince Adamski, Pheoll Mfg. Co.; Freeman Anderson, National Lock Co.; and Paul Van Sittert, Rotor Tool Co. Speakers for the second day included S. S. Kahn of Parker-Kalon; Robert Scott, Gagnier Fiber Products Co.; James R. Pontius, National Machinery Co., and Douglas Dickenson, Grip Nut Co.

BLACK AND DECKER NAMES FIELD MANAGER

Black and Decker Manufacturing Co., product service division, has announced the appointment of Charles L. Costa to the position of field manager of the division. He will supervise the company's product service organization throughout the country.

Also announced was the appointment of three branch service managers; James C. Vassell, manager of the Lincolnwood (Chicago) branch, David S. Stevens, manager of the Seattle branch and S. Michael Raymond, manager of the Des Moines branch.



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once locked, it's got to be *cut* loose! Really permanent! Solid nylon. One size for diameters ⅛" to 1¾".

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use only where and when needed. Can be pre-mounted for simplified planning. Solid nylon.

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One piece all metal
GRIPCO CLINCH NUT
With or without self-locking threads. Hex collar prevents turning when torqueing bolt.

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GRIPCO PILOT PROJECTION WELD NUT
With or without self-locking threads. Centering collar positions nut and protects threads from weld spatter.

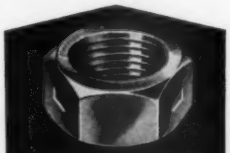
FASTENERS—

Service—40 sales representatives all over the country for prompt, fast service.

Reliability—Quality controlled by the oldest established lock nut manufacturer in the U.S.

Stock—Large inventories to ensure out of stock delivery on all catalogued items.

Speed production and lower costs on your products with this GRIP NUT family of GRIPCO FASTENERS. Qualified fastener engineers are available for consultation on all your assembly problems. Consult the yellow pages in your phone book under "GRIPCO" for the one nearest you.



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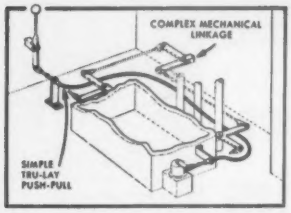
TRU-LAY PUSH-PULL DATA FILE SHOWS HOW TO SIMPLIFY AND IMPROVE DESIGN



Push-Pull remote controls, shown here, are flexible, have but one moving part, and give a lifetime of accuracy. Mechanical linkages are complex, are made of many parts, wear at many points, and produce increased backlash, lost accuracy, and vibration rattles.

This Push-Pull Data File—containing 7 engineering bulletins—will show you how these flexible controls have eliminated mechanical linkages on hundreds of products. You can make *your* products more useful, easier to sell, with Push-Pull controls. Write for your Data File today.

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Low-cost, portable, compact equipment. Job-tested to 98% accuracy. Saves time and material. Single point control. Handles viscosities from 0 to 20,000 C.P.S. at room temperature. Selective 1 to 1 up to 20 to 1 component ratios for flow or spray direct from original 5 gal. pails or 55 gal. drums.

Simple operation, easy cleaning, versatile and economical.

Write for complete literature and prices.

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EXCLUSIVE AGENT FOR HARTFORD SPECIAL

The Hartford Special Machinery Co., Simsbury, Conn., has announced the appointment of Roy Machinery Sales, Inc., Farmington, Conn., as exclusive agent in the U.S. and Canada for Hartford's thread roller machines. The sales firm is headed by president Emil Roy.

Roy is the holder of several machine patents, and is credited with the development of a high speed header which was introduced to the market last year.

Roy Machinery Sales, Inc., is also sales agent for the Roy screw slotter, high speed header and a parts washing machine.

ELECTRIC EYE, WHEATON ENG. MERGE

Through the merger of two Illinois manufacturers of electronic and mechanical components and automatic controls a new corporation, called Hurletron, Inc., has been formed.

The merger combines the assets, personnel and engineering facilities of Electric Eye Equipment Co., of Danville, with those of the Wheaton Engineering Corp., Wheaton.

The principals of both divisions effected the merger, and were assisted by the First Electronics Fund of Chicago.

CONTINENTAL SCREW OPENS WAREHOUSE

The addition of a warehouse in Richmond, Ind. by Continental Screw Co., New Bedford, Mass., will stock Phillips and slotted wood, machine, tapping, and thread cutting screws, as well as many special products manufactured by the company.

The opening of the warehouse will enable the company to service its customers in the midwest, southwest, and western areas better, according to the company.

SPECIAL RIVETS
like some of the samples shown here . . . or the more commonly used tubular and split rivets . . . they're all alike to the American Rivet Co. And always—our own special brand of quality and service that gets you what you want when you want it.
THE AMERICAN RIVET CO., Inc.
847 N. Kedzie Ave., Chicago 51, Ill.
Write for price list. For specials, send specifications for prices.
AMERICAN RIVETS
BUY AMERICAN Tubular and Split RIVETS

Use postpaid card. Circle No. 282

SALES MANAGER OF ENGELHARD DIVISION

Harold J. Billington, Jr., has been named sales manager of the H. A. Wilson Division of Engelhard Industries, Inc., Union, N.J.

With Engelhard for the past six years, Billington is now in charge of the overall sales activities of the division, which manufactures such products as thermostatic bi-metals, electrical contacts and assemblies of platinum, silver, gold, tungsten, and other industrial products.

DAY'S PAY TO CHARITY AT STANSCREW

With several contributions still expected from vacationing employees, the Chicago Screw Co. division of Standard Screw Co. raised more than $11,000 for Chicago and suburban Community Chests.

Since 1952, an "extra" workday (Saturday) has been scheduled and employees donate all or a large precentage of this day's earnings to the Community Chest of their choice.

During the nine year life of the joint company-union program, more than $106,000 dollars have been raised.

TOWNSEND BUYS BOOTS AIRCRAFT NUT

Townsend Co. of Beaver Falls, Pa. acquired the assets and business of the Boots Aircraft Nut Co.

F. R. Dickenson, president of Townsend, said that no changes in sales or other policies are planned. All personnel will continue in their present capacities.

The new division will be aided in its own expansion program by the research and development facilities of Townsend and by using multiple manufacturing, marketing and warehouse facilities of the parent company.

D&B

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WIRE FORMS—SPRINGS and METAL STAMPINGS

D-&-B Parts deliver top performance at lower cost! Years of KNOW-HOW and quality control guarantee Wire Forms, Springs and Stampings that are easily assembled . . . withstand stress . . . and perform under the most trying conditions!

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FREE Brochure

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For variety of torque uses. Audible signal when desired torque is reached. Easy adjustment. Four sizes: maximum torques from 75" lb. to 225' lb. Female adapters in driving head; male adapters on torque base.

Heavy Duty Jaw Controlled (Torque) Drive Stud Driver

New heavy duty jaw brings the ultimate within reach for users of self-opening stud drivers.

Predetermined amount of torque can be applied to stud during driving. For use with any air or electric drill or drill press. Sizes No. 101—No. 102—No. 103.

"Bull Dog" Stud Driver

Designed for Use With Impact Wrenches

Built for rugged use on heavy engines. Equipped with Titan Design, Loose Pressure Plunger. Definitely stands up under vibration encountered when using an impact wrench for motive power.

Titan "Roll Grip"

Combination Stud Driver and Puller

Incorporates roll action to grip as little as ½ in. of unthreaded body of stud. Made in standard sizes from 3/16 to 3 in. inclusive.

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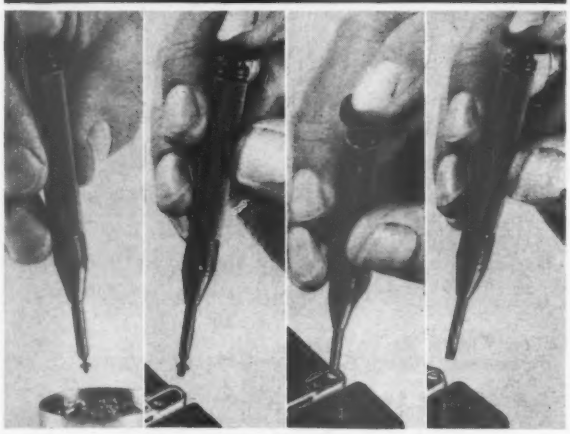

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ONE LAST WORD

JUST ANOTHER YEAR! REALLY?

With nothing remaining of the holidays except bills and pieces of tinsel under the rugs, and a nostalgic, and maybe a nagging, guilty feeling over what's happened to the good cheer and the bright promise of the holiday season, we now address ourselves to the new year. It will appear to be a year like all other years, fraught with sickness, joy, sorrow, pain, frustrations and all the other ills and blessings with which mankind trundles its way through life, for better or for worse. Good business, poor, spotty, uncertain business, new products, minor successes, failures, and the usual horse opera intellectualism of tv. Yes, seemingly, just another year. Really?

As we sit quietly in our office, or when we drive to work, or simply relax in the big red easy chair by the fireside, isn't there a thin, small voice mumbling at us that all is not beer and skittles? Doesn't there flash through the mind a sickening feeling of walking on ice across a river? Solid ice, to be sure, but don't we wonder, how thick and how safe?

We say this year will be like other years, with one exception: clouds, at one time no bigger than a man's hand, and with black, jagged edges, will hide a larger part of the heavens. Imports are starting to rob us blind (a larceny many manufacturers encourage); exports are going the way of all flesh; our dollar is spotted with slight fissures and a creeping cancer; communism is gaining in strength. This is the year these clouds will expand. They could darken this land in just a few years.

And we answer these clouds with complacency, assuming blithely that they will dissipate, like a common cold, if given time. So we let our equipment rust in aged facilities, and proceed on the cheery note that 1961 will be just another year. And this is our big mistake.

The first thing we must do is to become aware of the problems. Really aware of them! Thoroughly and completely recognize that they exist and that they will not solve themselves. We must understand that the government will not solve them. Only industry can solve the problems; only industry can lick competition; only industry can make jobs; only industry can maintain our standard of living. No one else can do this. And that means you and me.

Let us awaken to the problems. Let the managers, engineers, production and sales executives with their technical acumen, with their ready minds and their old fashioned Yankee energy, face up to the situation and begin to think. We must shake off this lethargy and growl, "Enough is enough. Get off our backs. You've had it."

At the precise moment that we face the problems, sit down and think and plan, and decide to do something about them . . . at that precise moment the importers, the communists, and the pack of price cutters will be on the run. If we do this, 1961 will not be just another year.

Wm. F. Schleicher

Vice President & Editorial Director

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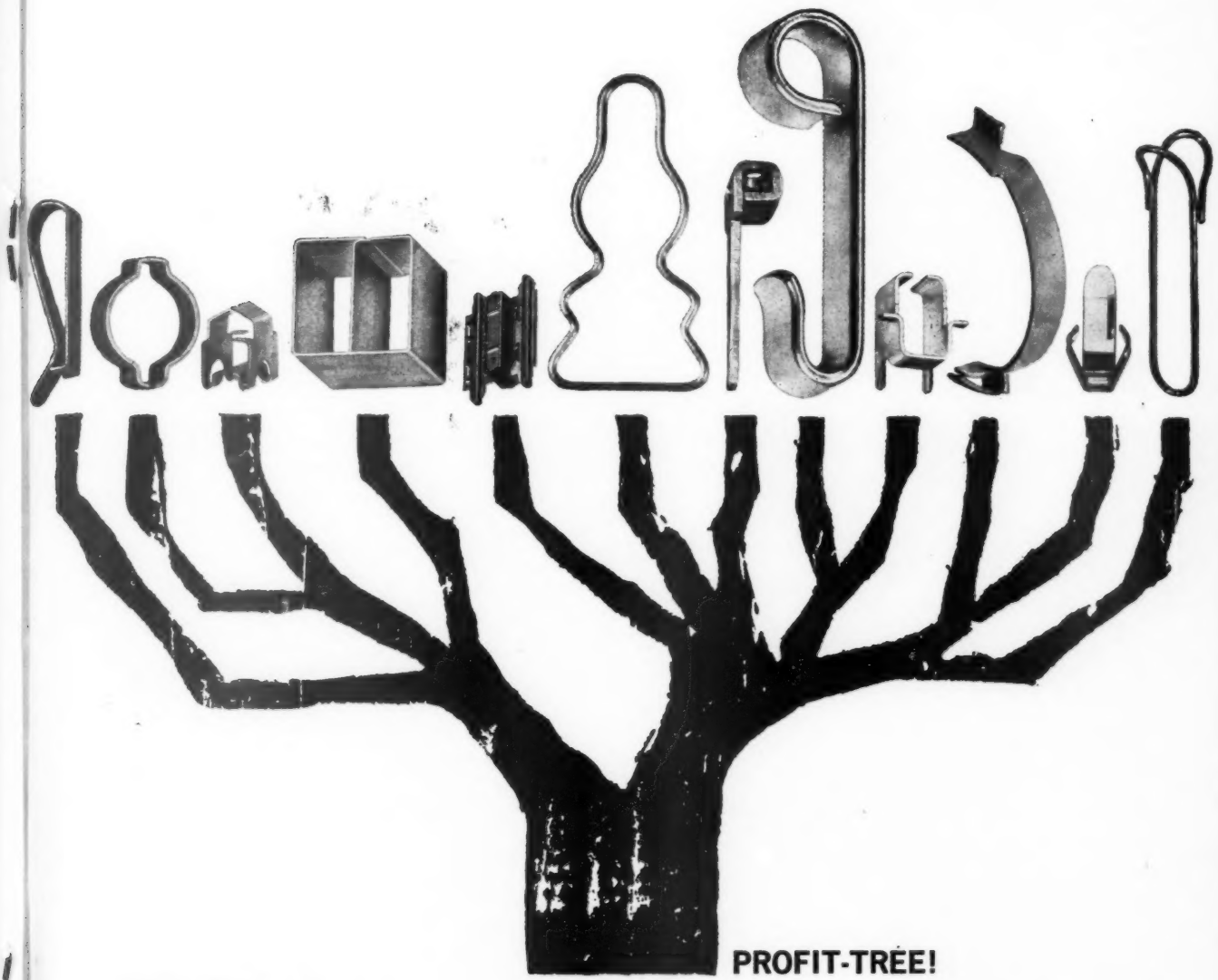

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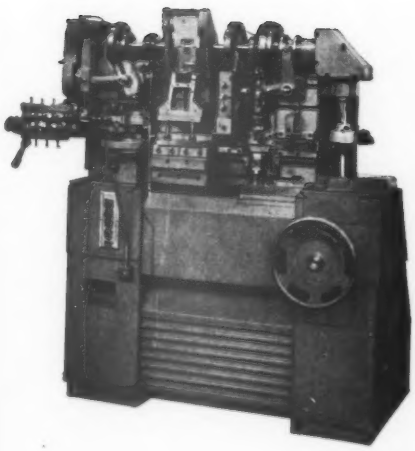

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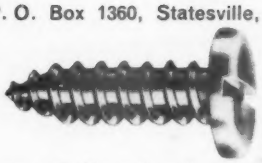

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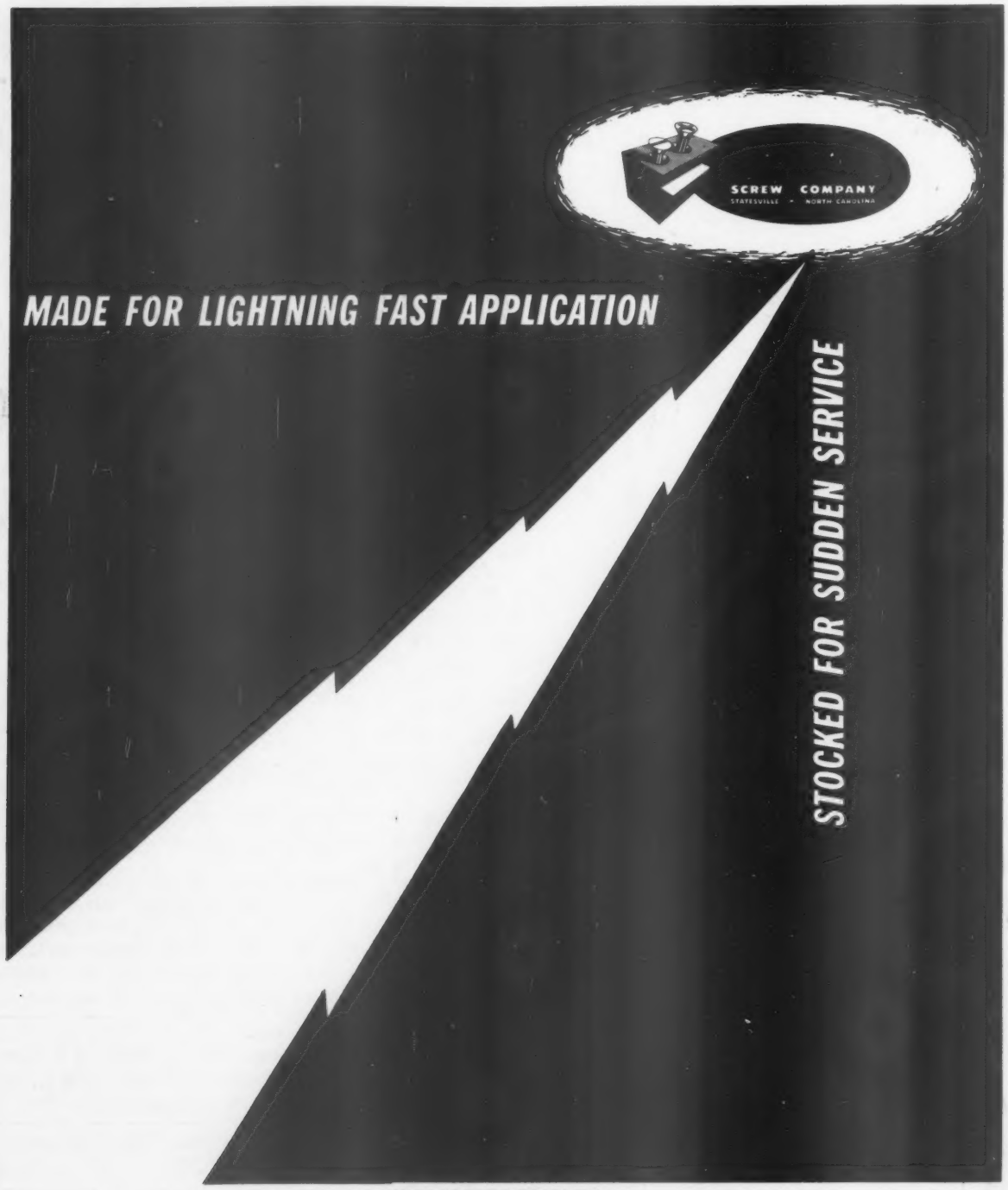

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